THE NURSING OF TUBERCULOSIS

By

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WITH A FOREWORD BY

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PREFACE

THIS book is written expressly for the nurses and student-nurses engaged in the nursing of tuberculous patients

Subjects such as pathology, aetiology, variations of the disease, etc, are dealt with briefly, as the details are not of vital importance to the nurse nursing measures are treated more fully, the main object of the book being to enable nurses to give the person suffering from tuberculosis all the care that is necessary to promote recovery, whenever possible, and to maintain the 'chronic' case in as comfortable a state as circumstances allow

The keen student may be stimulated to read up in other more academic text-books particular subjects mentioned, and this is all to the good so long as her practical work does not suffer she should remember that her first duty is to NURSE THE PATIENT with skill and kindliness, and all the knowledge which she acquires should be used to this end

For encouragement and help in the preparation of this book we owe thanks to Dr R R Trail and to Dr Kenneth Murray

O V B
P M M M

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FOREWORD

By

RICHARD R TRAIL

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THIS handbook will supply a much-needed treatise on the nursing of tuberculosis It has been confined very wisely to practical necessities in the modern sanatorium It gives concisely the essentials of knowledge in anatomy, physiology, and signs and symptoms which the nurse must possess if she is to understand the reasons for her work with and without the aid she can have from the Medical Officer It stresses throughout the personal aspect of her duties, and devotes one chapter to the psychology of the tuberculous patient, a subject which is now claiming much attention in the literature of tuberculosis All sanatorium workers realize the necessity for keeping in mind at all times the human end of treatment The book should therefore be most useful to all Trained and Assistant Nurses who intend to take the Certificate of the Tuberculosis Association

THE NURSING OF TUBERCULOSIS

CHAPTER I

AETIOLOGY

HUMAN tuberculosis is an infectious disease caused by the transmission of the *Bacillus tuberculosis* from an infected to an uninfected individual It is now considered that it is not a hereditary disease though it may occur in some families for several generations, nor does the fact that a person contracts the disease mean that he is predisposed by heredity The theory that the offspring of tuberculous parents are predisposed to the disease is now discounted by many physicians, although it is difficult to explain on other grounds the particular danger to which a near relative is exposed in nursing a case of open tuberculosis

The children of tuberculous parents may develop the disease through negligence of the parents For example, the mother may fondle and kiss the child, she may cough while preparing its meal and droplets of sputum may fall into the food, or, if the child has a 'dummy', it is quite possible that she will moisten it in her own mouth before giving it to the child Therefore it can be said that tuberculosis in childhood is due to infection from the mother, by ingestion or inhalation

The Grancher system organized in France many years ago seems an admirable method of protecting the children of tuberculous parents The principle is that of a 'boarding out' system for the children until they are grown up and the danger of contracting the disease by an initial mass infection or by many and often repeated infections is past

The consent of the tuberculous mother is first obtained before removal of the child, as soon after birth as possible, if only the father is infected the child is not removed if the parent is in a sanatorium and not likely to come in contact with the child This system is used extensively in France and has shown favourable results

Predisposing Factors—It is stated that, taking all age groups into consideration, male cases of tuberculosis are of greater number than females In adolescence and early adult life the number of females is greater, but after forty years of age a greater proportion of males develop the disease One reason given for this is that females tend to mature earlier than males and the responsibilities of life are felt at an early age There is also the possibility of endocrine gland disturbances during puberty being a contributory factor If the death rates from all forms of tuberculosis are studied it will be noted that many infants die from meningitis and acute generalized forms The lowest death-rates are found in the ages between five and fourteen years Between twenty and twenty-five years of age the rate in females is highest, among males the ages between thirty-five and thirty-nine show the greatest number of deaths

The associated conditions of poverty and overcrowding may be one of the reasons why tuberculosis is more prevalent amongst poorer classes than it is among the rich Low income, resulting in insufficient nourishment, emotional strain, and financial worries tend to lower resistance, and therefore predispose to infection and retard recovery

Dark, ill ventilated dwellings in unhealthy environments, such as city slums, where the only playgrounds children have are the sunless and dusty streets, do much to spread tuberculosis Large families live in the minimum of space, and the houses are often damp as well as dark and airless It is in such surroundings, alien to good hygiene, that disease runs riot, because mental and physical stamina are lowered

Quality as well as quantity is required in the diet in order

to keep the body resources at par Regular meals of good plain food, properly balanced and well cooked, are the chief essentials for the tuberculous person, missed meals and sketchy meals mean under-nourishment Unsuitable diet, lacking in fats and vitamins, promotes the onset of tuberculosis by reducing those inherent resources which are summed up in the word 'resistance'

Certain trades are said to be especially prone to tuberculosis, chiefly those which are dusty and those which expose the worker to severe climatic conditions Masons, quarrymen, and workers in asbestos factories and on sugar plantations tend to suffer from various forms of chest diseases, all of which come under a common heading of 'pneumoconiosis' These predispose to tuberculosis, and are dealt with in a little more detail in a later chapter

Long hours of work, followed in many cases by a journey in tram, 'bus, or train, leave little time for leisure Such leisure time as is available is often spent injudiciously in stuffy cinemas, crowded dance halls, and public houses, in an atmosphere of smoke and stale air Rest, fresh air, and exercise graded to the physique of the individual are the antidotes to such conditions of life and work which act as a threat to good general health

There is little doubt that prolonged mental strain is a contributory factor to tuberculosis Enquiries into the history of cases admitted to sanatoria will often reveal that a long period of anxiety has existed This may be due to family difficulties, unhappiness at work or at home, individual mental conflict in the state called 'psychoneurosis', or fear about employment, with the resultant loss of income to the patient and his dependents

Pregnancy may have a harmful effect on a latent focus, but it is not a predisposing factor of tuberculosis Many doctors agree that it is wiser for a woman who has had tuberculosis not to have children, but if she so desires, that a period of not less than two years after the arrest of

the disease should elapse before commencement of pregnancy There is a saying that appears to have the backing of experience, it is that a woman recovered from pulmonary tuberculosis can survive one pregnancy, she may survive two pregnancies, she seldom survives three pregnancies Strict medical supervision should be given during the antenatal period, and for at least six months afterwards In addition to this, the expectant mother should observe regular periods of rest daily The normal post natal period in bed should be extended by at least one month, and monthly radiographs of the chest should be continued for six to nine months afterwards Should an active lesion be diagnosed after the patient has become pregnant, the degree of activity and length of time to elapse before confinement will decide whether or not the pregnancy should be terminated In the case of a toxic patient with a pregnancy of less than two month's duration, it should be terminated surgically by dilatation and curettage, but in the case of one of two to eight months' duration and mild activity the patient may be allowed to go to full term Should the patient wish the pregnancy to continue against medical advice it will be necessary to secure early control of the lung lesion by inducing an artificial pneumothorax on the affected side, and/or crushing the phrenic nerve, combined with absolute rest antenatally After confinement the patient should continue to have absolute rest for three to six weeks, with one pillow and the foot of the bed elevated, this helps to keep the diaphragm raised To facilitate uterine drainage the blocks should be removed for one hour twice a day If it is not possible to control the lesion by collapse therapy its progress must be closely observed, if it does not extend it may be possible to let pregnancy continue and induce labour at thirty four weeks, but if it does extend, termination by hysterotomy may have to be resorted to

A child born in a sanatorium should be removed immediately after birth and should be bottle fed

CHAPTER II

THE BACILLUS AND VARIATIONS OF THE DISEASE

THE great Greek physician, Hippocrates, recognized the disease more than two thousand years ago, and described its typical features It was not until 1865, however, that Villemin, a French physician, demonstrated by inoculating susceptible animals with tuberculous material that the disease was specific and infectious, and it remained for Robert Koch, a German doctor, in 1882, to prove that the tubercle bacillus only, which be successfully cultivated on an artificial medium, was the cause of the disease This discovery by Koch of the causative agent, sometimes called the 'Koch bacillus', was undoubtedly the most important event in the study of the disease Another important event was the introduction of the stethoscope by a Frenchman named Laennec, in the year 1819 This enabled physicians to hear more clearly abnormal sounds in the chest and was a great step towards the earlier diagnosis of cases

The recognized types are four in number (1) Human type, (2) Bovine type, (3) Avian type, (4) Piscine type

The human type is found extensively in man under natural conditions, and is sometimes found in domestic animals By experimental inoculation it can cause disease in certain susceptible animals

The bovine type is found in cattle and may be transmitted to man by milk from an infected herd By their growth in culture medium and the inoculation of susceptible animals it is possible to differentiate the human and bovine types For example, the rabbit is susceptible to the bovine type and relatively immune to the human type, while the guinea-pig is susceptible to both

The avian and piscine types attack birds and fish respectively and have little known reference to human tuberculosis

Human pulmonary tuberculosis due to avian tubercle bacilli is rare, though a few cases have been reported, both in this country and abroad A case of pulmonary tuberculosis showing sufficient evidence to regard the causative agent as the avian tubercle bacillus was reported in this country in 1942 (Bradbury and Young) During the ten to twelve years prior to his illness the patient had bred over one hundred budgerigars, also he had been in the habit of taking a raw egg beaten up in milk each day for several years Raw eggs have been found to contain living avian tubercle bacilli (Feldman, 1938) The patient is reported to have responded to avian tuberculin, but not to human tuberculin

Under microscopical examination the bacillus presents a slender rod-shaped appearance, it is about 5μ in length, straight or slightly curved, and is of uniform thickness There is no characteristic 'grouping' as seen in some types of bacilli, nor does it show movement It is enveloped by a 'fatty' covering which enables it to retain the red stain, known as carbol fuchsine, used for detection in laboratory tests It is distinguished from other bacilli by its staining properties, it is characteristic that it "takes the stain with difficulty and retains it with tenacity" Its resistance to acid after staining has earned for it the name of 'acid fast bacilli'

To produce tuberculosis the bacillus must find a home in a human or animal body Once it has found suitable soil it reproduces rapidly if it is not destroyed by inherent or acquired resistance in the human body Outside the body the bacillus can exist, but does not reproduce itself Exposure to direct sunlight is said to kill it in a very few minutes, carbolic, mixed with infected sputum, renders it sterile in five to ten minutes Should a person suffering from active tuberculosis spit in the street, the fluid part of the sputum

will soon dry up, leaving a particle of dust This dust may contain many tubercle bacilli, which lie dormant, but ready to revive as soon as they come in contact with moisture They may remain alive in the dark, dusty places for many days, the 'fatty' envelope surrounding them acting as a protection against harmful agents, so that they show great resistance to destruction

Post-mortem examinations have revealed that in most civilized communities the majority of the inhabitants have, at some period in their lives, been infected by tuberculosis On the other hand, examinations on stillborn children and those who have died in early infancy have shown no evidence of tuberculosis, so one must conclude that infection is not hereditary, but is acquired in later life Although many people become infected, comparatively few suffer any inconvenience and fewer still develop active disease This is because they possess immunity, natural or acquired, or both

By immunity is meant the ability of the body to control the harmful activities of invading organisms, natural immunity is the power of resistance with which one is born Acquired immunity is the power of resistance which develops in the body resulting from actual contact with the disease This has been developed in most civilized communities because many generations have lived in areas where the disease is endemic It is lacking in many coloured races as they have not been in contact with it for more than two or three generations, with the result that infection usually means progressive and fatal disease Town and city dwellers are more exposed to infection than are those who live in country districts because the chances of contact with active disease are greater, this does not mean that the death-rate in towns is higher, but rather the reverse It is possible that prolonged exposure to innumerable infections has increased the immunity of the town-dweller A falling death rate has been noted in countries where industrialization is of long standing, in those where industrialization is actively

progressive the rate is stated to be noticeably rising, where there is no change industrially the mortality remains almost stationary

During the last fifty years the incidence of tuberculosis in Great Britain has shown a steady decline, with the exception of the two war periods, 1914–18 and 1939–45, when there was a marked increase in the number of cases reported In the recent European war lack of fresh air due to black-out conditions and sleeping in air-raid shelters caused much physical and emotional stress, this greatly lowered the resistance of the civil population, while coincident overcrowding made contact infection almost impossible to avoid

Such increase in the incidence of tuberculosis in war-time has called for measures to combat it, these measures may have effects with benefits in years to come Thus factory medical services have improved and it is now possible for employees to consult a nurse or welfare worker and to see the works medical officer Miniature mass radiography, too, has proved a valuable asset in the diagnosis of the early case This was instituted as a result of the recommendations of the Medical Research "Committee on Tuberculosis in War-time", under the chairmanship of Lord Dawson, and which were set out in the Government Circular 266/T Any person whose miniature radiograph is not satisfactory has a large film taken, and if it shows evidence of disease full clinical investigation is carried out and appropriate treatment is arranged The Committee also recommended a scale of treatment and family allowances for those who might be rehabilitated to take their place again in normal industry Tuberculosis physicians hope that these allowances, which were granted as a war-time measure, will be maintained and even increased in the future

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CHAPTER III

MORBID ANATOMY

THERE are three ways by which the tubercle bacillus can enter the human body (1) Inhalation, (2) Ingestion, (3) Inoculation.

1 *Inhalation* of infected dust or sputum from an infected person by, for example, careless coughing and spitting is the most frequent method of infection.

2 Infection by *ingestion* may be caused by drinking infected milk, by swallowing sputum, and by the careless use of crockery and cutlery which has not been sterilized after use by a sputum-positive case Food left on the dishes of sputum-positive cases can be highly infectious It follows that it is possible for food to become infected by a nurse who omits to wash her hands after making beds, doing dressings, and bed-pan rounds

3 Infection by *inoculation* through a cut or abrasion of the skin is rare, although pathologists are liable to contract tuberculous warts The germ may enter the body through infected tonsils or teeth or by sinus infection, but such happenings are rare

On examination, an organ which is the site of tuberculosis shows small translucent nodules, under microscopical examination these nodules are seen to be made up of a number of small tubercles, embedded in surrounding tissues The size and shape of a nodule vary the average is like a large pin head and of spheroidal shape If a tubercle is cut across, a firm yellow or greyish surface is presented, where the size is larger than a pin-head a soft cheesy centre or a bead of pus may be seen The following description will help the reader to visualize the structure of a tubercle (*Fig* 1)

a Central zone In this zone are found the bacilli, the effects of their irritation are shown by an exudate which is a discharge of fluid from the surrounding tissues A few cells possessing several nuclei and called 'giant cells' are found in this region

b Middle zone Here are found a number of single nucleated cells, oval in shape, placed round the exudate and 'giant cells'. These are called 'epithelioid cells', and

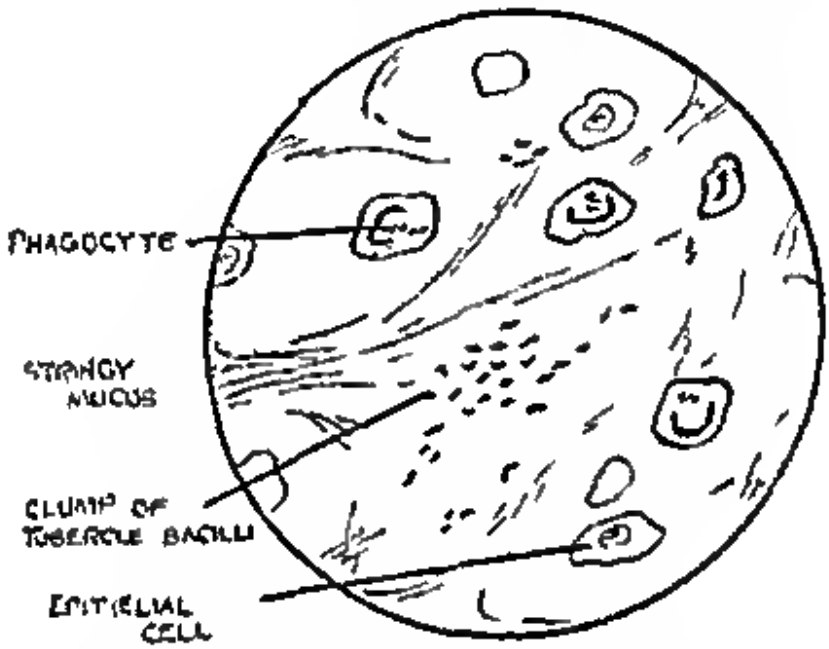

Fig 1.—Structure of a tubercle

are said to be derived from connective-tissue cells in the vicinity of the original irritation

The middle and central zones constitute the first response of the tissues to invasion by the tubercle bacillus

c Outer zone. A layer of lymphocytes, derived from the blood and lymph streams, is found here Each cell is small and rounded, and is supported by a network of connective-tissue fibres This network forms a framework for the whole tubercle It consists of small cells with nuclei, from the ends of which long fibrils find their way to the surrounding tissue Fibroblasts, from which fibrous tissue

cells originate, will develop in this layer if there is a protective response

A group of such tubercles make up the typical tuberculous nodule As a result of poor nutrition the tubercle, which is avascular, tends to necrose in the centre, the dead tissue forming a 'cheesy' mass (caseation) This caseous matter liquefies, forming tuberculous pus, which may break through the tubercle and find its way to the surface The result is an abscess, which is referred to as 'cold', there being none of the redness and throbbing associated with the usual abscess of inflammatory origin The breaking down of a tuberculous focus in the lung and the discharge of caseous material through the connected bronchus, leads to cavitation

If the tubercle formation is allowed to continue an increasing area of healthy tissue will become involved in the process Necrosis (death of tissue), extensive caseation, and destruction follow Fibrosis may limit the spread of disease in one direction, while extension occurs in another Cellular activity may cease at any stage in the tubercle formation process The affected area may become completely encapsulated by fibrin, and the lesion contract into a fibrous scar extending into the centre

The whole area of infiltration may become absorbed if the caseous process has not gone too far In some cases the area of caseation is converted into a chalky mass by impregnation with lime salts, this process is known as 'calcification'

Tuberculosis usually attacks the lungs in adolescents and adults, and bones and joints and lymph glands in children, but a tuberculous lesion is liable to occur in any organ of the body, in the intestines, peritoneum, kidneys, generative organs, larynx, meninges, and skin (lupus vulgaris) These infections can occur separately or as complications of pulmonary tuberculosis The usual result of inhalation of tubercle bacilli is a lesion in the lung, this may occur in any part of the lung, but is most commonly found in the

lower part of the right upper lobe, near the pleura, and is known as a 'Ghon's focus' (*Fig 2*)

Drainage of this lesion along the lymphatics causes infection and enlargement of the lymph-glands around the hilum of the lung The combination of primary focus and enlargement of glands is known as the 'primary complex' In a great number of cases the primary lesions, or foci, heal and

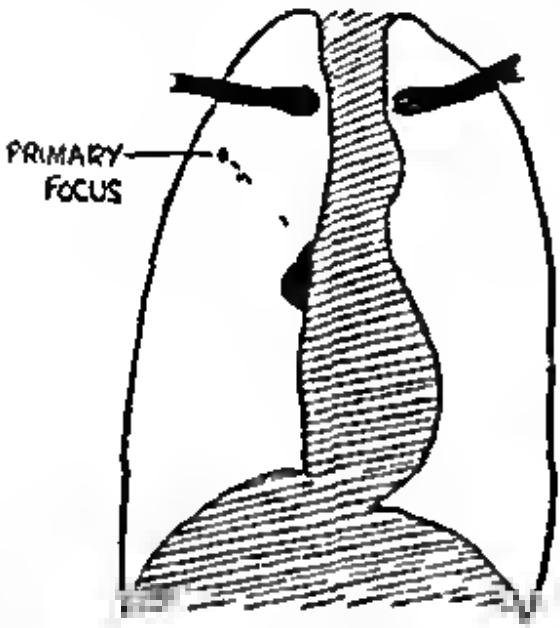

Fig 2—The 'primary focus' followed by enlargement of the hilar glands ('primary complex')

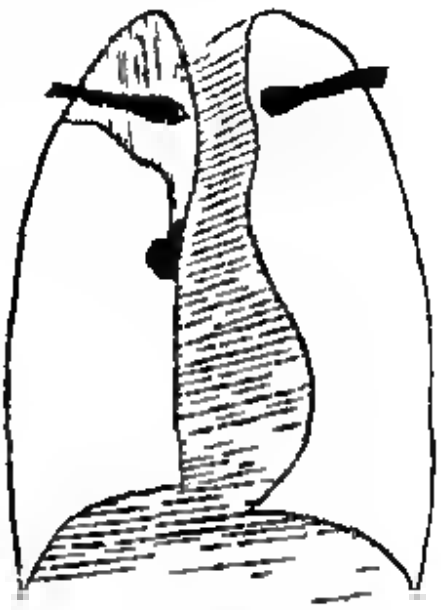

Fig 3—Pulmonary tuberculosis

calcify, though there are cases in which they do not heal, but spread and cause cavitation When the area in the primary focus is extensive the hilar glands may become so enlarged as to cause pressure on an adjacent bronchus, thereby blocking the air-supply The airless lobe will collapse and together with the inflammatory condition in the lung will cause a solid pulmonary area to develop This consolidation may involve the entire lobe (*Fig 3*)

Disseminated tuberculosis can occur when the bacilli enter the blood-stream through a blood-vessel opened up in a tuberculous lesion Disease is liable to develop in any part of the body Post-mortem examinations reveal that the

organs are studded with tubercles, this condition is called 'miliary tuberculosis' (*Fig* 4) Such cases are rapidly fatal, a high percentage of them develop tuberculous meningitis, which is usually the primary cause of death

The most common type of tuberculosis in the adult is chronic pulmonary tuberculosis, which is characterized by gradual destruction of lung tissue by spreading lesions which

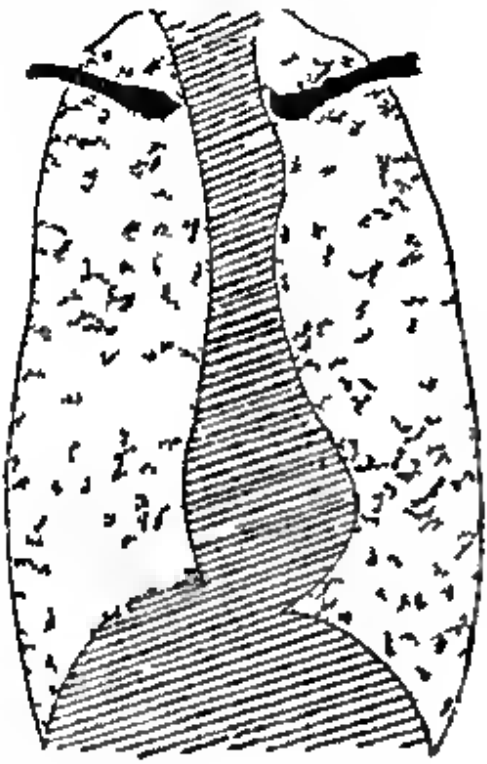

Fig 4.—Miliary tuberculosis

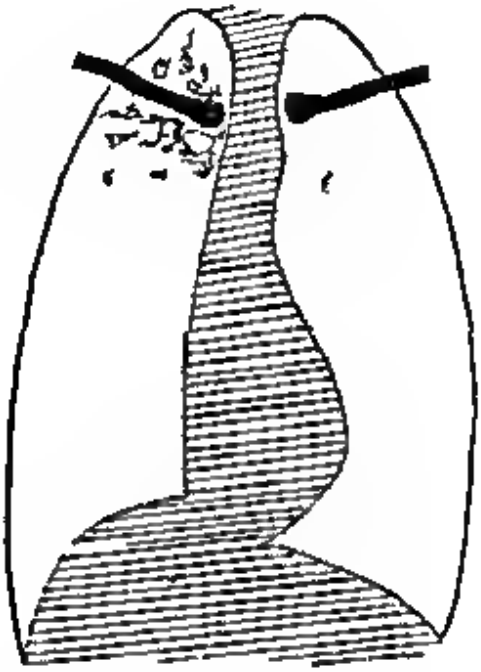

Fig 5.—Fibrocaseous disease.

are both caseous and fibrotic The disease spreads by direct extension by the lymphatics and by the blood stream A varying degree of toxæmia accompanies this condition

The degree of resistance developed by the patient is largely responsible for the course of the disease in any individual The process is rapid in many cases, large areas of the lung becoming involved, in others there is a tendency to produce fibrous tissue, which controls and confines the disease Thus we can differentiate such forms as broncho-pneumonic tuberculosis, where caseous patches are scattered

through the lungs, usually in all lobes, and the massive pneumonic type involving one extensive area, e g , consolidation of a whole lobe There is a liability in both types to rapid breaking down of tissue and so to cavity formation. These cavities may be too small to show on the X-ray film, or so large as to involve the greater part of a lobe , most adult cases are described as 'fibrocaseous tuberculosis' (*Fig* 5), but the term includes forms varying from the very acute to the long standing and chronic The most commonly affected site at onset is the right subapical region, but infection is not confined to this area

Caseation, liquefaction, cavitation, and fibrosis occur in differing proportions It follows that chronic fibroid tuberculosis differs from the acute forms, by the production of a great amount of fibrous tissue within the actual lesions In later stages the fibrosis may cause considerable scarring and contraction of the lung so that respiration becomes impaired

CHAPTER IV

ANATOMY OF THE CHEST AND MECHANISM OF RESPIRATION

In order to understand the signs, symptoms, and treatment of pulmonary tuberculosis it is essential that the nurse

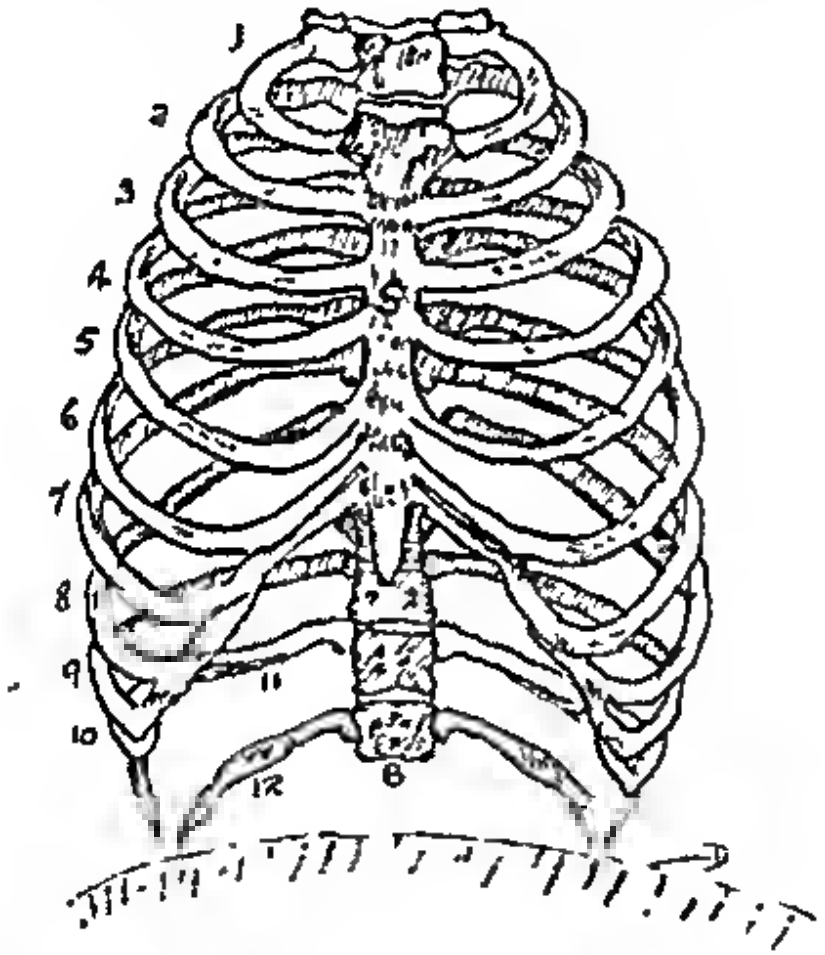

Fig. 6.—Bony framework of the chest. 1–12, Ribs; 8, 12th dorsal vertebra; S, Sternum; D, Diaphragm

should be familiar with the structure of the chest and the process of respiration. The following diagrams will serve to illustrate the main points in the anatomy of the thorax.

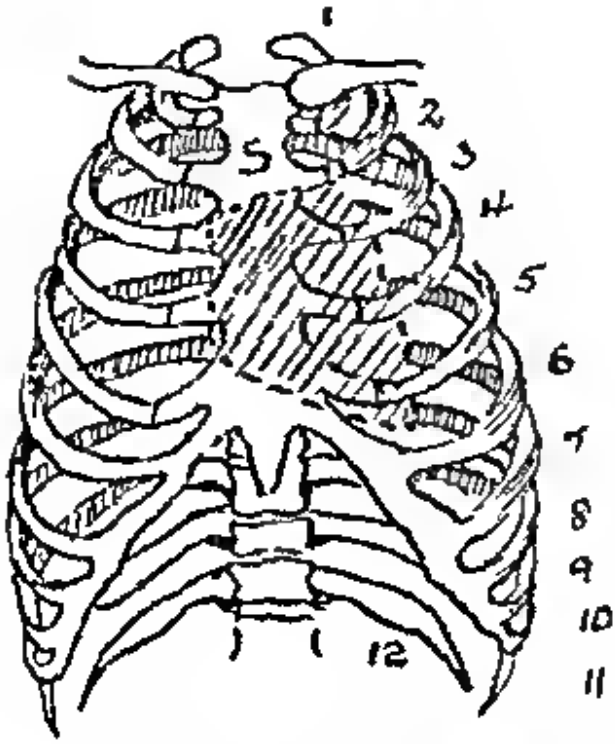

Fig 7—Framework of chest, showing position of heart
1–12, Ribs; S, Sternum.

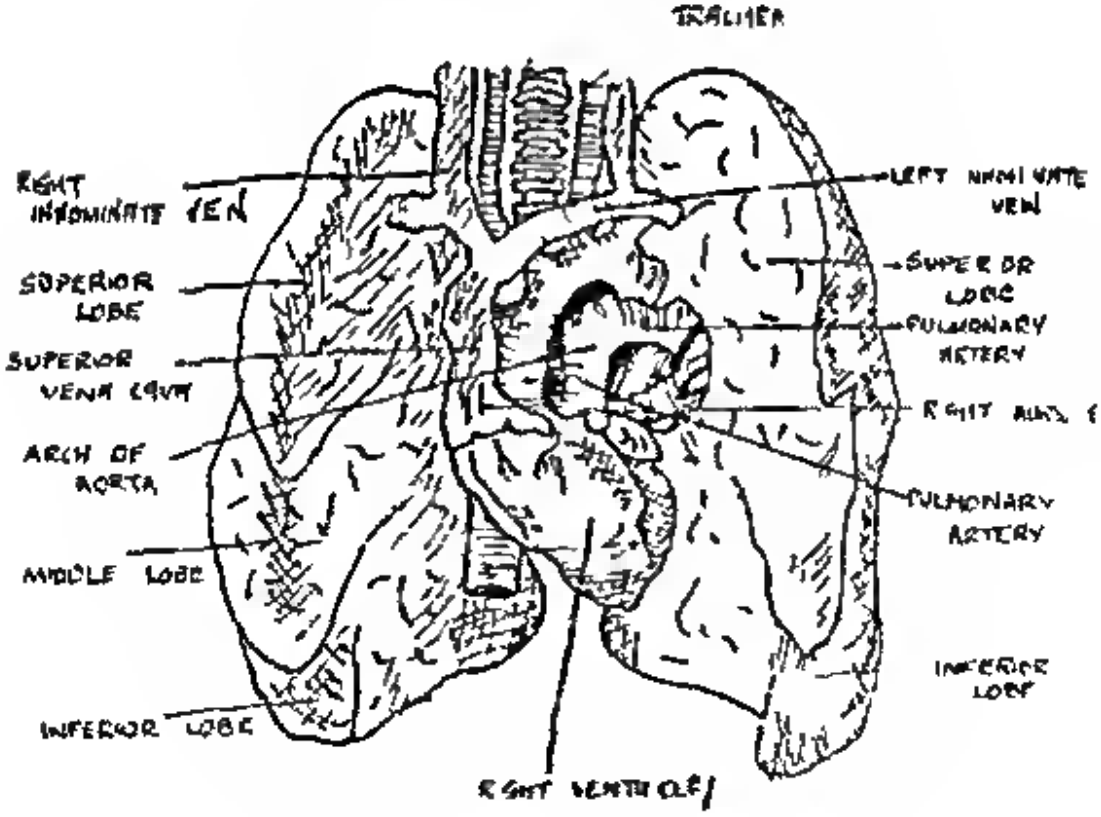

Fig 8—The heart, lungs, and great blood-vessels

Boundaries of the Thoracic Cavity (*Fig* 6) —

Anteriorly (in front) the sternum (breast bone) and costal cartilages

Posteriorly (behind) the 12 thoracic or dorsal vertebræ

Laterally (at the sides) the ribs and intercostal muscles

Below the diaphragm

Above the root of the neck

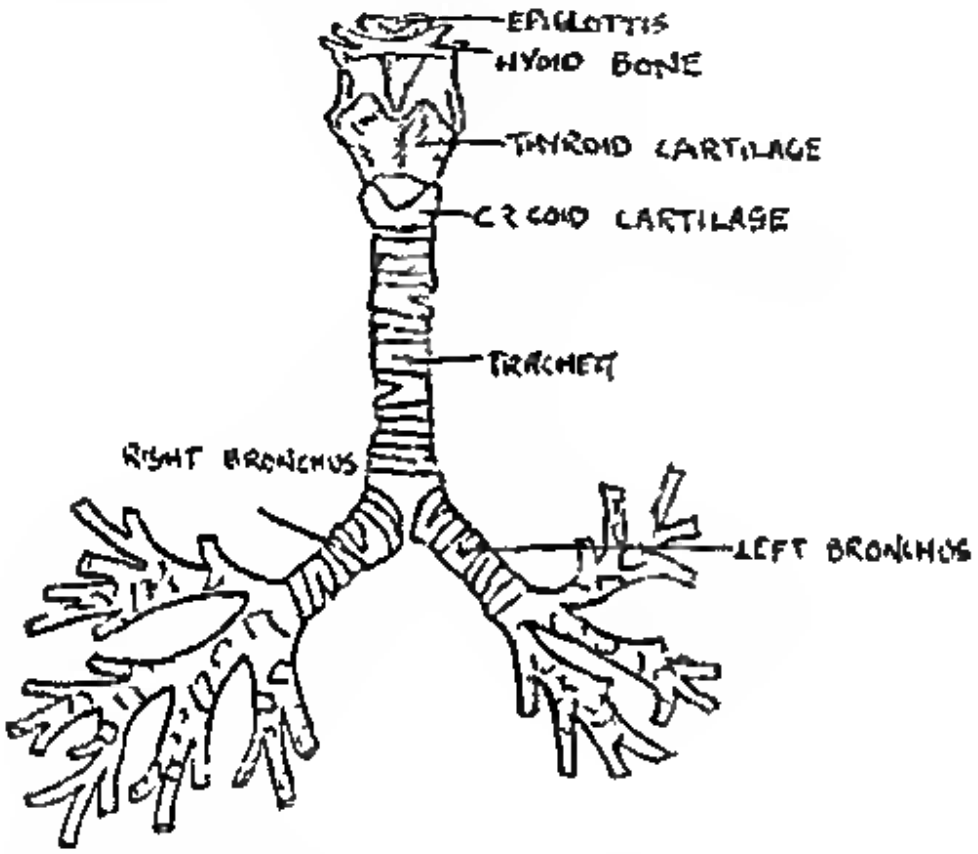

Fig 9.—The trachea and bronchi.

These structures form a bony framework which gives shape and solidarity to the chest and serves to protect the thoracic organs (*Fig* 7)

Contents of the Thoracic Cavity (*Fig* 8) —These are the lungs and the space between them, which is known as the mediastinum This space contains the lower portion of the œsophagus and trachea, the heart with its great blood-vessels, the thoracic duct, the vagi and the phrenic nerves, and various lymphatic glands

Anatomy of Trachea and Bronchi (*Fig* 9)—The trachea (or wind-pipe) is a hollow tube, 4–4½ in long and 1 in wide It extends from the larynx to about the level of the 5th thoracic vertebra It is composed of 16–20 incomplete rings of cartilage Posteriorly each ring is completed by a band of fibrous tissue thus the anterior surface is

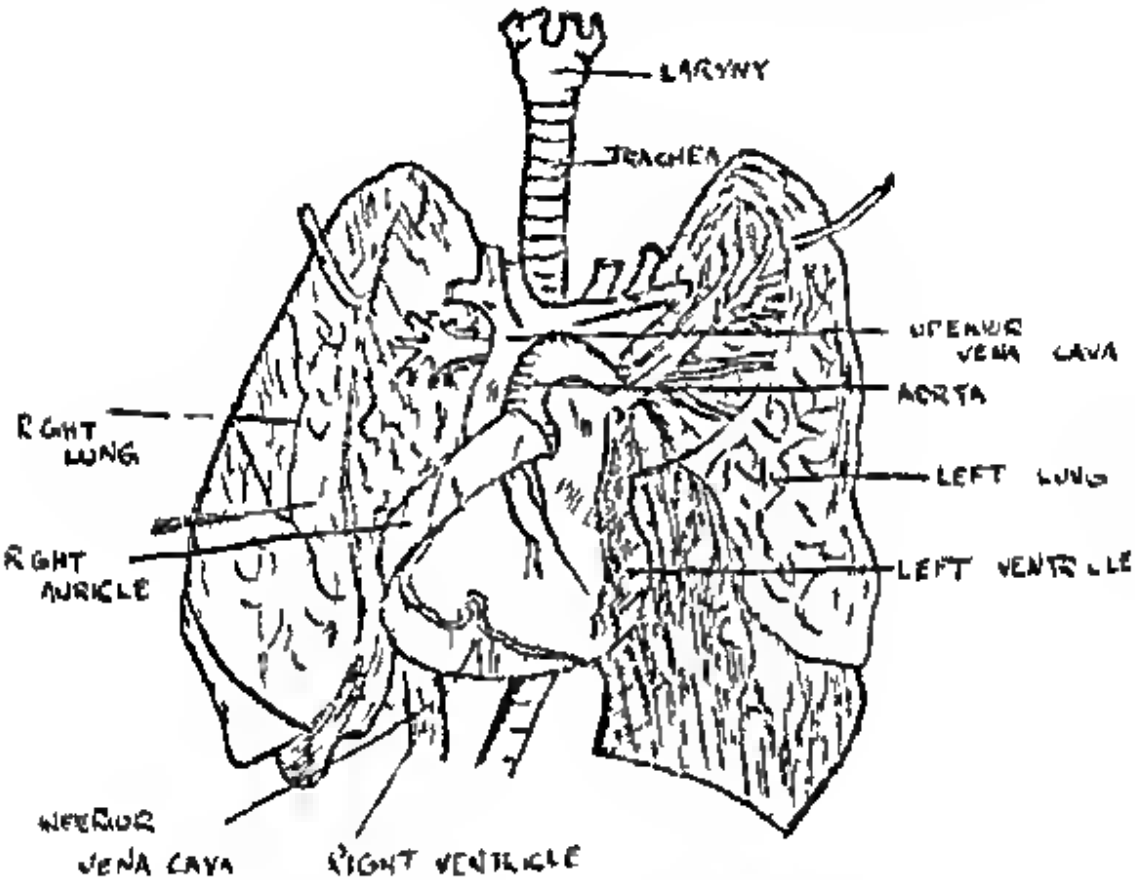

Fig 10.—Diagram of heart, lungs, and air passages

rigid and the posterior soft It is lined with mucous membrane consisting of ciliated epithelium and goblet cells The cilia (fine hair-like processes) are capable of a 'waving' movement directed upwards, so that foreign particles, e g, dust, are expelled The cervical trachea is crossed by the isthmus of the thyroid, the lobes of the gland lying one on either side of the trachea Immediately behind the trachea and parallel to it is the œsophagus (or gullet)

At the level of the 5th thoracic vertebra the trachea divides to form the right and left bronchi (the right bronchus going to the right lung and the left to the left lung) The bronchi are similar in structure to the trachea The right bronchus is 1 in. in length and wider than the left, on entering the lung it subdivides into smaller branches As one of these is above the pulmonary artery it is known as

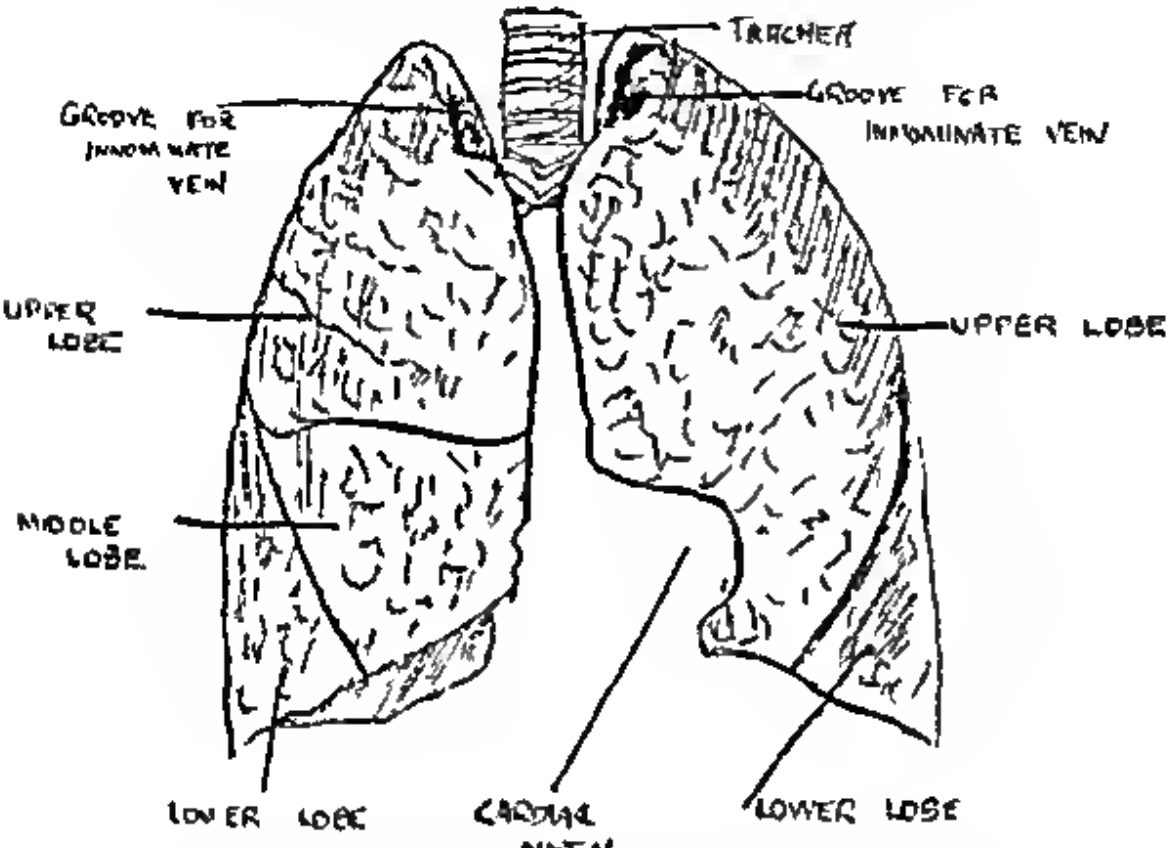

Fig 11.—Diagram to show division of lungs into lobes

the eparterial bronchus, the other branch (as it is below the artery) is known as the hyparterial bronchus, the left bronchus is 2 in. in length. it passes below the pulmonary artery before subdividing, and therefore its branches are hyparterial

The Lungs (*Fig* 10) —These are the true organs of respiration and are light, spongy, and elastic They are conical in shape, and lie one on each side of the thorax, with the heart

between Their concave bases rest on the diaphragm and their apices extend up towards the root of the neck The right lung is divided into three lobes, upper, middle, and lower, the left into two lobes, upper and lower (*Fig* 11) The left lower lobe is concave on its inner surface to allow for the position of the heart, the greater part of which lies to the left of the midline Each lobe is made up of lobules, bound together by areolar tissue and supplied with air by the ramifications of bronchioles (small bronchi) which terminate in the alveoli or air-cells Each terminal bronchiole

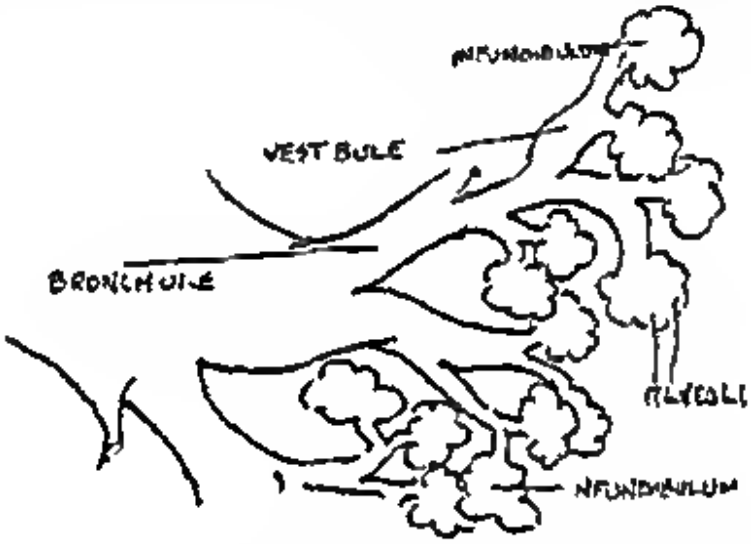

Fig 12.—A bronchiole

opens into a passage—the vestibule—lined with flattened endothelial cells, and ending in a triangular structure, the infundibulum In the walls of the infundibulum are the air-cells Each alveolus (*Fig* 12) is surrounded by a plexus of minute capillaries which are the final divisions of the arteries The internal appearance of the lungs when magnified may be likened to a bunch of grapes The close proximity of the air-cells and capillaries makes possible the interchange of gases during respiration, i e, through the porous walls oxygen is supplied from the alveoli to the capillaries, which in return give up their carbon dioxide.

Each lung is covered by a double serous membrane, the pleura, the inner, or visceral, pleural layer covers the lung closely, lying around it and between the lobes, at the hilum it is reflected back to form the outer or parietal layer which is in contact with the chest wall Between these two layers is a slight exudate which acts as a lubricant and prevents friction during breathing the parietal and visceral layers are in close contact (apart from the exudate) and the so-called pleural space (or pleural cavity) lying between them is therefore only a potential one If air or fluid is introduced between the layers by pneumothorax or pleural effusion the space becomes an actual one

The right and left pulmonary arteries carry de-oxygenated blood to the right and left lungs respectively, these are the only arteries to carry 'impure' blood the right and left pulmonary veins carry re-oxygenated blood from the right and left lungs to the left auricle of the heart for re distribution to the body via the aorta, the pulmonary are the only veins to carry 'pure' blood

The Diaphragm.—This is a strong dome-shaped muscle dividing the thorax from the peritoneal cavity it contracts and relaxes during respiration The two halves, right and left, are supplied by the right and left phrenic nerves

Mechanism of Respiration—On inspiration the diaphragm is pulled downwards, enlarging the chest vertically, while the intercostal muscles contract, elevating the ribs and sternum The elastic lungs are thus able to fill in the increased space and so air is drawn into the air passages On expiration the diaphragm rises and the intercostal muscles relax, and, as the lungs recoil, air is breathed out One inspiration plus one expiration equals one respiration The normal respiration rate in the adult is 17 20 per minute

Vital Capacity.—This is the volume of air that passes in and out of the lungs by a forcible inspiration and expiration. The volume is made up of tidal air (the amount used in ordinary quiet breathing), complemental air (an extra

amount taken in by forced inspiration), and supplemental air (that which is expelled by forced expiration)

Example —

Tidal air		500 c c
Complemental air		1500 c c
Supplemental air		1500 c c
Vital capacity	Total	3500 c.c

The means by which vital capacity may be measured is described in the chapter on SPECIAL TESTS

N B —The lungs are never completely emptied, after expiration 1000–1500 c c of residual air remains

CHAPTER V

SYMPTOMS OF PULMONARY TUBERCULOSIS

PULMONARY tuberculosis is usually of insidious onset, and lesions may be well advanced before the patient complains of symptoms The early ones, such as cough and loss of appetite, are often so vague as to be overlooked until the disease is well advanced and the patient is really ill The early case is often difficult to diagnose except by radiography of the chest Not all the following symptoms are likely to be found in any one case of active disease, but some of them are almost certain to be present (1) Cough with or without sputum, (2) Hæmoptysis, (3) Night sweats, (4) Pain, (5) Anorexia, (6) Dyspnœa, (7) Tachycardia, (8) Loss of weight, (9) Temperature and fever, (10) Lassitude

Cough and *sputum* may be due to other conditions than pulmonary tuberculosis, such as excessive smoking, catarrh, or bronchitis, but they should always call for special examination when they last for more than a month The cough of pulmonary tuberculosis is, as a rule, 'loose' and sputum is easily brought up, though there are cases where it is viscid and calls for great effort for its removal Vomiting sometimes accompanies the paroxysms of coughing caused by this type of sputum Tubercular or catarrhal laryngitis is sometimes the cause of an irritating and unproductive type of cough, and the laryngeal inflammation may be maintained because of this Unproductive coughs are apt to become a habit, therefore as much restraint as possible must be practised to suppress them Change of position may cause sputum which has collected in a cavity to find its way to the bronchi, from whence it is expectorated, the cough is often

Loss of weight, when accompanied by cough and sputum, is highly suspicious of pulmonary tuberculosis It may be due to digestive and metabolic disturbances, causing anorexia, or to insufficient nourishing food or a diet badly balanced and lacking in fats and vitamins Under sanatorium treatment the appetite tends to improve, but is not always followed by an increase in weight, owing to the inability of the patient to assimilate his food properly An increase in weight is regarded as a favourable sign, indicating that the treatment is doing good Routine weighing of patients is of great importance and should be carried out at regular intervals, both in the sanatorium and, after discharge, at the chest clinic or dispensary

Fever nearly always accompanies active tuberculosis, the temperature may be raised two or more degrees without the patient being aware of it The elevation occurs usually in the evening, the chart showing what is known as the 'diurnal swing' The difference between morning and evening temperatures often leads to increase as the disease progresses

Temperature is a valuable indication of the progress, and should be recorded with accuracy Fever may be produced by toxic absorption, pleurisy, spread of disease, and over-exertion Reduction of temperature by rest in bed and fresh air indicates that the treatment is having the desired effect

'Inverse' temperature—that is, when the morning recording is higher than the evening one—is regarded as a very unfavourable symptom, indicating as a rule the rapid downward progress of the patient

Varying degrees of *lassitude* are found in most cases of active tuberculosis due to toxæmia

The treatment of all the above symptoms will be found in CHAPTER VI

CHAPTER VI

TREATMENT OF PULMONARY SYMPTOMS

As detailed in CHAPTER V, the symptoms of pulmonary tuberculosis are (1) Cough with or without sputum, (2) Hæmoptysis, (3) Night sweats, (4) Pain, (5) Anorexia and digestive disturbances, (6) Dyspnœa, (7) Tachycardia, (8) Loss of weight, (9) Temperature and fever, (10) Lassitude

1. **Cough**—If this is persistent, irritating, and non-productive the patient may be encouraged to suppress it Warm drinks will help to allay the irritation, and lozenges such as menthol and blackcurrant, troch. phenol, or troch. pot chlor will soothe the larynx A cough syrup may be ordered, especially at night, e g, linctus scillæ or linctus diamorph, or, in some cases, elixir diamorph or syrup codeinæ phosph.

If, on the other hand, sputum is present, the cough must not be suppressed, but encouraged in order to induce adequate expectoration this does not mean that the patient must cough all the time, he should cough when he is conscious that sputum needs to be expelled, continual coughing is exhausting and useless If the sputum is viscid, and expectoration difficult, medicines containing potassium iodide or ammonium carbonate are given three times daily, while a hot saline mixture (sod chlor and sod. bicarb) given immediately on waking is most beneficial Linctus should not be given to patients with this type of cough unless specially ordered In some cases the doctor will order one dose of a sedative cough mixture at night to promote sleep by preventing coughing

General sanatorium conditions should do much to lessen a troublesome cough, which is always increased by ill-ventilated rooms and unhygienic surroundings

The nurse should remember that after some operations, e g , induction of an artificial pneumothorax or a thoracoscopy, the patient should be told to try to suppress his cough, while after others, e g , thoracoplasty, he must be encouraged to cough

2 **Hæmoptysis** —This term means 'spitting of blood', the nurse must not confuse it with 'hæmatemesis', which is vomiting of blood from the stomach In hæmoptysis the blood is coughed up from the lungs and may vary in amount from a teaspoonful to several ounces, if sputum is produced which is stained with blood the patient is said to be 'staining' The amount of blood coughed up must be measured Hæmoptysis is always the most alarming symptom from the patient's point of view, in a hitherto undiagnosed case it is the symptom which will send him post haste to the doctor even if he has ignored other symptoms such as cough or sputum In hospital the spitting of blood is no less alarming, and the first duty of the nurse is to reassure the patient She should preserve a calm and quiet demeanour and try to impress upon the patient that it is a fairly common symptom and not nearly so serious as it appears She should prop the patient up in a comfortable position and hold the sputum mug for him while he is coughing The Sister or Nurse-in charge should be informed and she will decide whether the condition of the patient warrants a visit from the doctor

It is doubtful if any measures will stop a hæmoptysis and it is not always desirable that the flow of blood should be dammed, otherwise the lungs may become logged with the fluid. Particularly from the psychological point of view *something* should be done, and it is customary to give an intramuscular injection of calcium gluconate or colloidal calcium 5–10 c c , or an injection of Congo red or vitamin K Congo red is given intravenously, usually by the doctor The doctor may order a hypodermic injection of morphine gr ¼, to allay anxiety and quieten a restless patient

Large doses of a sedative cough mixture should NOT be given as they tend to dry up secretions which require to be expelled

The nurse must stay with the patient during an attack She should have a bowl of cold water, swabs, and a receiver on the locker so that she can clean the patient's mouth and lips frequently It is important that the patient should not think he is *in extremis* because of this extra attention If he questions the nurse as to why she is staying with him she should make some excuse, and, if he has ceased to cough, may busy herself about the ward or talk to him of other things As a rule, most patients are apprehensive, whether they admit it or not, and will be grateful for the nurse's presence, and take it for granted

If the bout is prolonged and more than an ounce or two of blood coughed up, the doctor will almost certainly visit the patient and he may give an intravenous injection of calcium gluconate 5–10 c c Amyl nitrite is sometimes ordered, this is contained in a glass capsule which should be wrapped in a piece of gauze or clean handkerchief and broken under the patient's nose, while he inhales deeply Amyl nitrite has one disadvantage in that it is liable to cause headache as the blood-pressure falls

Ice may be given to suck, and cold compresses and ice-bags on the chest are sometimes used, but it is doubtful if they have any real value, though the ice-bag may serve to keep the patient still.

During an attack and for some time afterwards the patient should be at absolute rest, and should not be allowed to exert himself in any way Diet after an attack need not be restricted, the patient being allowed to take as much as he feels he can

Constipation may be troublesome following hæmoptysis, and it is advisable to give a saline aperient on the following morning as this will open the bowels easily and also lower the blood pressure

3. **Night Sweats.**—Ordinary sanatorium conditions will do much to mitigate this uncomfortable symptom (more properly termed 'sleep-sweats', as they may occur also during daytime sleep) The nurse should see that fresh air is adequate during sleep, and that the bedclothes are neither heavy nor too numerous Belladonna is often ordered to be given orally at night Excessive perspiration will necessitate sponging and changes of pyjamas and bed-linen

4. **Pain.**—This occurs generally when pleurisy is present or when the lesion is immediately underlying the visceral pleura The doctor will order drugs if necessary, the treatment of pleural pain is dealt with elsewhere in this book

5. **Anorexia and Digestive Disturbances.**—The cause of digestive disturbances should be ascertained, and the possibility of an intestinal infection kept in mind Minor symptoms such as flatulence or nausea may be dealt with as they arise, hot peppermint will often relieve the former and glucose the latter If vomiting occurs after meals it is probable that the patient is taking too much food and the diet should therefore be adjusted Good food is essential for the tuberculous patient, but the stomach should never be overloaded Some patients believe that the more food they take the more rapid will be the cure, and they overeat accordingly A patient who is taking no exercise does not need and cannot assimilate enormous meals, if he tries, his stomach rejects the food and more harm than good results

For persistent nausea a dose of sodium bicarbonate will usually prove effective Frequent vomiting irrespective of the amount of food taken and the times of meals should be regarded as a most unfavourable symptom and should be reported in order that it may be investigated

Abdominal pain is rare and is usually due to flatulence unless there is some intestinal infection

Anorexia—loss of appetite—may occur as a result of digestive disturbances, the patient feeling too nauseated to

eat or being afraid to eat for fear of discomfort The appetite will improve when adequate measures have been taken to deal with the 'indigestion' Other causes are anxiety, lack of exercise (especially when the patient is first put to bed after leading an active life), a monotous diet, or badly-cooked food Appetite may be stimulated by mist gentian before meals, or, if obtainable, ale or stout or some apéritif

If the patient is anæmic an iron or strychnine tonic will help considerably and the appetite will improve The remedies for a monotous diet, poor quality food, or badly-cooked or served food are obvious!

6. Dyspnœa.—The nurse should note the degree of breathlessness, whether it is always present or only on exertion, if it is spasmodic, and if it is becoming more acute

The patient should be supported by pillows in the position in which he finds breathing easiest, and not allowed to exert himself Oxygen may be necessary in severe cases Drugs which may be ordered by the doctor are ephedrine gr ½, or Anestan tablets orally, or, in cases of spasmodic dyspnœa due to asthma, a hypodermic injection of adrenaline min 5 In many cases the dyspnœa is due to pleurisy, the treatment of which is described elsewhere

7. Tachycardia.—It is likely that this symptom will disappear with the rest, providing the chest condition improves No special treatment is necessary unless cardiac complications are present

8. Loss of Weight.—A good mixed diet, with meals at regular times, will tend to increase weight, providing that the chest condition is improving and the patient is free from mental strain Nurses should remember that one cannot expect a patient with active disease to put on weight In some sanatoria only ambulant patients are weighed, they are usually 'good chronics' or convalescents and can be reasonably expected to put on weight or to maintain a fair weight. It is not desirable to weigh, weekly, those patients

whose condition is deteriorating—a persistent decline in weight is depressing, and the nurse would do well to explain to the patient that weighing will not be carried out until he is up and about again because of the exertion

9 Fever.—No special treatment is necessary to reduce temperature except in hyperpyrexia, ordinary sanatorium régime and treatment for the pulmonary lesion will lessen fever

10 Lassitude.—This, again, will respond to sanatorium regime Rest in the fresh air, suitable diet, and the requisite local treatment will build up the patient's resistance and reduce the toxæmia which has caused the tiredness

CHAPTER VII

SANATORIUM RÉGIME

As fresh air is a very important item in the treatment of tuberculosis, the ideal situation for sanatoria is in the open country, away from the smoky atmosphere of towns Specially situated localities have not been found to produce any definite influence on the progress of the disease, while in bracing climates the patient undoubtedly feels better, this might prove a disadvantage in some cases as he is liable to over-do his activities and in consequence retard recovery

The majority of modern sanatoria consist of blocks of buildings with operating theatre, X-ray departments, heliotherapy department, and wards fully equipped for the nursing of cases in need of special care, while, in some, ambulant cases are housed in chalets in the grounds

Individual rooms should have painted walls which can be washed, rounded corners to prevent the collection of dust, wood or rubber floors easily washed and polished, and as little furniture as possible Single or double cubicles with plenty of air space and admitting the maximum of light are found in all modern buildings French doors, opening on to a verandah, are most useful, as beds can be wheeled outside if desired Curtains are not advisable as they tend to harbour dust Movable screens should be provided for each cubicle to ensure privacy for washing, bed bathing, and treatment. Ample storage room in built in cupboards should be provided Central heating is usually employed instead of open fires round which patients are apt to congregate in cold weather, while the electric fans do much in hot weather to add to the comfort of the person who has to spend his day in bed

5–7 p m	Recreation, smoking, reading, and radio
7 p m	Supper time
9 p.m	All ambulant cases in bed
10 p m	Lights out and radios off, except when special permission is given by the physician to listen to late programmes This is not encouraged, but is permitted occasionally

This scheme is modified by the physician to suit different cases, but the essential features such as rest hours and meal times are not altered It is preferable that all rest hours are taken on the bed completely relaxed

Rest, fresh air, and good food are the three chief essentials from which the person undergoing treatment in a sanatorium is expected to derive most benefit, it is therefore important that the nurse sees that the orders of the doctor are carried out with regard to all three

On admission to a sanatorium the patient is put to bed, usually on absolute rest, that is he does not get out of bed for any purpose whatsoevet X ray examination is carried out by means of a portable apparatus brought to the bed-side

This period of rest is followed, provided the patient's reaction is satisfactory, by one of graduated exercise, that is the patient begins to get up, first for a little time in a chair, later for toilet purposes, and later still for one hour in a chair Time out of bed is slowly increased until he is up all day He is then allowed to go for a short walk, and the distance is increased by the physician as he thinks fit From graduated exercise he is promoted to graduated work, and so, very slowly, he resumes a practically normal mode of living as far as hours of work and rest are concerned Should there be any unsatisfactory reaction to exercise or work, such as an increase in temperature, the grade is reduced until it is normal again for a few days

So far no counter acting remedy has been discovered for tuberculosis, and therefore the treatment is not specific There are, of course, drugs and chemicals capable of

destroying the bacillus, but unfortunately the body tissues would be destroyed first if they were used in sufficient strength to be effective

The two aims of sanatorium treatment are —

1 To raise and maintain the general resistance of the patient

2 To promote healing of the lesion and to limit the spread of disease by local treatment—collapse therapy

The feeding of tuberculous patients has long been recognized as one of the fundamental items in treatment A well balanced diet of good plain food, rich in fats and vitamins, is essential Butter, eggs, milk, and cream are all good items of diet, but all cases cannot digest these foods, therefore the deficiency must be made up in some other way Digestive disturbances and 'fickle' appetites must be catered for, tonics to increase the appetite are usually prescribed by the physician and vitamins may be administered in capsule form or as cod-liver oil and malt

The feeding of the toxic patient is often difficult, milk and milk foods, white fish, preferably steamed, and meat juices are the most used Eggs, baked in custard or raw in milk, may be given provided they do not produce gastric disturbance All food should be fresh, as bad or tainted food may react rapidly on the digestion Meals should be served hot, as soon as they reach the ward, into dishes already clean and heated, and the food neatly served It is better to have the patient ask for a second helping than have him nauseated by a heaped plate of food with gravy slopped over it A fixed weekly menu should at all costs be avoided as the patients get into the habit of forecasting the next day's meals, so that good food is not appreciated because of monotony

The temperature of the patient is of great value to the physician as an indication of the progress of the disease, it is most important that it is recorded with accuracy There are four methods by which the temperature may be

taken—in the mouth, rectum, axilla, or groin In the oral method the thermometer is placed beneath the tongue, and should remain there for three to five minutes at least In the rectal method the thermometer is placed in the rectum and left there for three minutes at least The rectal method is influenced by any inflammatory condition around the anus, and may not always give a true recording Rectal temperature often registers half a degree higher than the oral in the same person To take the temperature in the axilla or groin the skin must first be rendered free from moisture, after which the thermometer is placed in the hollow and the arm or thigh folded over it against the body Time for accurate registering varies, but eight to ten minutes should be sufficient

Recording of weight is of equal importance and patients should be weighed at regular periods, preferably at the same time of day and wearing as nearly as possible the same clothing The nurse should record each weight as the patient is weighed, otherwise errors may occur and prove misleading Weighing machines should be tested periodically to ascertain their accuracy, and patients should stand perfectly still while being weighed, as the slightest movement may cause a variation in recording

Measurement of sputum is another item of importance to the physician Each patient is supplied with a sputum mug or flask in the morning Into this is placed one ounce of disinfectant, usually 1–20 carbolic, the quantity must be definite, otherwise a faulty measurement is obtained Next morning, or sooner if the patient has copious sputum, the whole contents are emptied and measured in ounces, the ounce of disinfectant already in the vessel being subtracted

Not all sanatoria use the same type of mug, but those in use should possess a lid, and be easily cleaned and disinfected The type shown in *Fig* 13 is made of white enamel and has a lid attached, so arranged that the patient can raise it easily with his thumb In a modern sanatorium special

apparatus, consisting of a steam pressure autoclave, is provided for the disposal of sputum and the sterilization of mugs The mugs and contents are placed in the autoclave and steam pressure is maintained at 12 lb for fifteen minutes The mugs are then removed and washed ready for use Where there is no special apparatus the sputum may be emptied in the sluice, provided the sewerage system is satisfactory, and the mugs boiled in a large vessel for at least one hour Flasks need not be boiled provided pure lysol or carbolic is used for washing them The type shown in *Fig* 14 is in most common use It is easily emptied and cleaned, and should contain a small amount of disinfectant Urine and fæces are disposed of in the usual way, after sterilization with pure carbolic or lysol All soiled linen should be soaked in disinfectant for several hours before laundering If linen handkerchiefs are used they should also be disinfected before being sent to the laundry If paper ones are used, clean ones are issued daily, the used ones collected in a suitable receptacle and sent to the incinerator This same principle applies to dressings Under no circumstances should handkerchiefs be used for sputum, this is highly dangerous as dried sputum is exceedingly infectious In sanatoria everywhere must be spotlessly clean Wards should be dusted with a cloth wrung out of disinfectant, and floors scrubbed or mopped daily as well as swept and polished

The personal cleanliness of the patient, too, must be stressed Patients who are ambulant naturally wash and bath themselves, but the nurse must see that this is performed as some tend to become careless Bed patients must have regular washing as well as attention to pressure points

The nurse should also pay strict attention to her personal cleanliness If the simple rules of hygiene are followed, such as a daily bath, washing her hands after attending to patients, teeth cleaning and gargling, there is little danger of her ever contracting tuberculosis while employed in sanatoria

CHAPTER VIII

SANATORIUM RÉGIME: SPECIAL METHODS AND REMEDIES

TUBERCULOSIS, which is a general disease with local manifestations, is treated basically by rest as already stated, but various other methods of treatment are employed in accordance with individual necessities

The methods chiefly used are collapse therapy (*see* CHAPTERS X, XI), general or local heliotherapy, calcium, gold salts, and tuberculin Heliotherapy or sunlight treatment is used extensively in sanatoria as well as in general hospitals, and has proved beneficial in nearly all cases of tuberculosis, with the exception of the pulmonary case Natural sunlight is substituted by mercury vapour and carbon arc lamps, producing ultra violet rays Two special types of lamp, the Finsen and Kromayer, are used for local treatment In general heliotherapy, artificial or natural, the treatment begins gradually, a small portion of the body is exposed daily until the whole body may be exposed with no ill effects The first exposure lasts about ten minutes, time is increased daily and the patient may spend hours in the sunlight eventually The physician usually decides the time of exposure as well as the distance from the lamp, which is as a rule two or three feet

Local treatment by artificial sunlight is carried out by one of the special lamps mentioned, which focus the light rays on to a small area of the skin The original of this type of lamp was first evolved in 1893 by a Danish professor named Finsen It has been in use in some hospitals in this country for many years, but as it is costly to instal it is unfortunately found only in a few of our hospitals A more recent edition of the Finsen light is now used with good effect With the

exception of the carbons, which are placed differently, this lamp, called the Lomholt Lamp, is very similar to the original Finsen A special device makes it possible for the applicator to be left under pressure on the lesion without constant attention Various types of applicators are used with this lamp, and such rays as are of no therapeutic value are absorbed by solutions of copper or cobalt sulphate, or by distilled water

The Kromayer lamp, less expensive than the Finsen or Lomholt, is also used extensively in the local treatment of skin diseases, including lupus The applicator is firmly pressed on the skin area under treatment, this causes anæmia of the area, thus allowing the rays to penetrate more deeply The lamp produces powerful ultra violet rays and exposure may cause severe reaction to superficial tissues, great care must therefore be exercised in its application, and the physician's instructions closely adhered to Certain dangers are of course associated with the administration of artificial light, and it is most important that the treatment should never be carried out without instructions from a physician Tinted glasses must be worn by everyone in the room where light treatment is carried out, as exposure of the eyes often leads to the development of severe conjunctivitis, and even cataract in cases of prolonged exposure

The majority of cases of glandular tuberculosis react favourably to light treatment, the patient can have either local or general treatment or both for this condition In cases of early tuberculosis of bones and joints excellent results have been obtained from prolonged treatment, but in chronic cases the results are not so good

Abdominal tuberculosis, too, has reacted very well to prolonged treatment, the patient's general condition being much improved and his weight increased In long standing conditions with possibly discharging sinuses the treatment must be carried out over a long period before results are

obtained, and calls for great patience on the part of the patient

In the treatment of lupus heliotherapy has proved most effective, long exposures are given at short distances

Heliotherapy is not commonly used in pulmonary tuberculosis as it is liable to 'light up' healed lesions in the lung, owing to this it is of great importance to note any cough or sputum developed by surgical cases undergoing light treatment

The heliotherapy department is usually in charge of a person fully qualified in the use of this type of treatment, so it is not necessary to go into detail here about the care of lamps and equipment used

Calcium is extensively used in the treatment of tuberculosis, and may be given orally in doses of one teaspoonful three times a day or by intravenous injection in a solution of chloride, or intramuscularly in the form of one of the proprietary preparations 'Kalzana tablets may be given to the patient to suck. There is not much evidence to prove that calcium treatment produces good results, but it is probable that prolonged treatment does lead to some improvement in the subacute or chronic case of pulmonary tuberculosis

There is still much difference of opinion regarding the use of gold salts for tuberculosis Occasionally a positive sputum case will rapidly become negative after or during a course of gold, and it is stated that it causes an increase in the fibrous tissue around the lesion, but it is not a cure for the disease

The method of administration is by intramuscular or intravenous injecuon, the salts being dissolved in distilled water

Severe reactions occur in some cases undergoing gold therapy, these are toxic complications such as albuminuria, dermatitis, fever, and gastro-intestinal disturbances, in some cases there may be nausea, loss of appetite diarrhœa,

and vomiting The nurse must watch for any of the reactions and report to the physician, who will decide whether or not to continue with the course A specimen of urine is obtained before the course is begun, and tested, this is done after each injection The presence of albumin is an unfavourable sign, and if it is persistent the course will be stopped Generous amounts of glucose should be administered on the day following each injection, this may help to prevent complications

Used as a treatment for tuberculosis, tuberculin has not proved to be beneficial Its most important use is as a test for detecting the infection of tuberculosis It does not distinguish between infection and disease, but is of value in determining the amount of tuberculous infection in a community Tuberculin is derived from cultures of tubercle bacilli grown on synthetic medium The various tests are dealt with in a later chapter

Another vaccine prepared from living tubercle bacilli which are grown artificially and repeatedly transferred from one culture medium to another, is known as B C G — Bacille Calmette-Guérin After many 'generations' the bacilli lose their virulence, and when injected into the human body confer a degree of increased resistance to the disease. On the Continent and in the U S A it has been used extensively, and good results have been reported, though it is maintained that severe local reactions have occurred in some cases

The tragic occurrence at Lubeck, in Germany, when a group of children were erroneously injected with the ordinary virulent bacilli, caused a set back in its use This error must not be attributed to the vaccine itself For fuller details see a later chapter

CHAPTER IX

THE PSYCHOLOGICAL ASPECT OF TUBERCULOSIS

PSYCHOLOGY (from two Greek words, *psyche*—mind, and *logos*—science) means the study of the mind, and is now beginning to take its place in general medicine In the past it has received too little attention, yet it is a most important aspect in all illnesses, and the patient may benefit to a marked degree if he is treated psychologically as well as physically

To give the patient the best that modern medicine can provide it is essential that all physicians possess a knowledge of psychology and apply it in practice This does not mean that all medical personnel must be fully-fledged psychiatrists, but an elementary knowledge of the subject applied where necessary will show encouraging results On observation it will be noticed that the patients of the physician who is interested in the psychological aspect of his cases as well as the physical, show more hopefulness and do not 'brood' over their illness This 'brooding', if unchecked, will lead to introspection, chiefly morbid, and may end up in depression—even suicide

If members of the medical and nursing staff of the sanatorium would interest themselves in the reactions of patients who have been ill mentally as well as physically and after proper treatment have recovered and returned to normal life, and put the knowledge gained into practice, they would be doing a great service to all suffering humanity

In a nurse the need for a psychological training is of vital importance if she is to understand the patients, to treat them individually, to learn the art of adapting herself to their different temperaments, and to obtain their confidence and

respect In every ward there are patients who are difficult to get on with and are prone to grumbling, but they can be treated as easily as the people who are pleased with everything if a little tact and common sense is used

The nurse must be pleasant at all times, and willing to listen to all the patient wishes to say, no matter how boring it may be By so doing she will make each patient feel that at least someone is interested in his case In return she can give advice regarding behaviour and encouragement to comply with hospital routine It is more successful to appeal to better judgement than to enforce rules The 'personal touch' is vitally important in dealing with all ill people A good nurse is capable of making each patient feel that he is being treated as an individual and allows no suspicion of favouritism to prevail

Psychology can therefore play a prominent part in the patient's progress towards recovery, for even in these days of 'enlightenment' there are many of the lay public to whom the mere suspicion of tuberculosis suggests that the sufferer is 'doomed' and is to be avoided at all costs Individual feelings can well be imagined when a person is told that he is suffering from tuberculosis and that a period of treatment in a sanatorium is necessary There is often a great deal of mental shock, followed by morbid introspection, which, if neglected, tends to lower the resistance and no amount of physical rest will re-establish this To alleviate the depression we must first know the cause, should this be chiefly worry over health, the physician can do much to help by explaining the individual physical condition and giving reasons for prolonged rest or specialized treatment and the benefits to be expected This will often produce a degree of hopefulness to replace despair that was totally unjustified The nursing staff can help to maintain such hopefulness in patients by going about their duties cheerfully and dealing with those little things liable to assume enormous proportions A word of encouragement can alter a whole outlook

Patients undergoing prolonged rest should, where at all possible, be allowed to feed and wash themselves, as otherwise a feeling of helplessness tends to ensue Reading should be encouraged, and light diversional therapy can cause the time to pass more quickly Rug-making, weaving on small hand looms, embroidery, and knitting are now popular with both sexes If work is exhibited and prizes awarded, the interest is increased by introducing a competitive spirit

Very ill people and those on absolute rest, and therefore not allowed up for any purpose whatsoever, must have all wants attended to by the nurse—blanket-baths, daily washing, teeth-cleaning, and gargling Often such people have to be fed as well All these duties must be carried out without any suggestion of haste, as it is so easy for them to feel that they are being a nuisance and taking up too much of the nurse's time

In sanatoria each patient is usually provided with a bell which he may ring in an emergency Often patients will ring bells for trifling reasons, but it is the duty of the nurse to answer ALL bells and not just to say "Oh! that's old So-and-So, he's always ringing for nothing" The one occasion on which she does not answer quickly may be the time of importance It may only be to pick up his newspaper from the floor, or to hand him something that he could quite easily have got for himself, but even so the bell must be answered and the request dealt with cheerfully and willingly

In the majority of modern sanatoria the wards are made up of single and double cubicles It is important that the people sharing a double cubicle are congenial to each other, as otherwise a strained atmosphere may result which will ultimately retard recovery of the individuals concerned Unsuitable companions should therefore be separated Single cubicles are used for the very ill cases chiefly, but there are many people who prefer to be alone, and if possible this wish should be granted On the other hand it is unwise to have a depressed patient too much on his own, and better

to find him a suitable companion who will prevent him from having too much time for morbid introspection.

Visitors do much to cheer the patient who spends all or most of the day in bed, and provided they do not interfere with ward routine—that is, with meals, rest hours, and treatment—and do not tire the patient unduly, they should be encouraged as much as possible A feeling of hope and encouragement is often increased by visits from ambulant patients who have been transferred from the hospital blocks to the sanatorium or convalescent sections Apart from being an 'outside' interest, these patients are only too glad to relate how ill they have been, how high their temperature had risen, and so on, thus causing the bed-patient to think "Well, he was more ill than I am, and look at him now!"

In many sanatoria, lectures are given to patients by the physicians and relayed through loud-speakers or earphones to bed-patients This is an excellent practice as it helps the patient to understand more about the disease and to dispel many of the morbid ideas he may have possessed on admission to the sanatorium

Rehabilitation, which is fully described in the last chapter, plays a great part in the recovery of the patient from a psychological point of view

The scheme in existence at Papworth Village Settlement in Cambridgeshire, England, is a splendid example, because not only is the patient given employment, but he is enabled to learn a suitable trade should it not be advisable for him to return to his former one If he so wishes he can obtain a house in the village where he can live with his family the life of a normal citizen, and work under medical supervision, secure in the knowledge that, should he have a 'breakdown' at some later date, he will be cared for in the hospital, while his job will remain open for him on his return This knowledge undoubtedly helps his progress towards recovery, as the problem of unemployment and all the economic worries it entails will not arise.

CHAPTER X

COLLAPSE THERAPY

ALL tuberculous lesions require general body rest if healing is to take place, it is therefore the basis of all sanatorium or special treatment As it is impossible for a patient to rest a lung completely, procedures to obtain local rest for the affected lung may be advisable The doctor in charge will decide if the case is a suitable one for collapse therapy and which form of collapse will be likely to prove most beneficial, and will always be prepared if one method fails to try another The various methods available are Artificial pneumothorax, Adhesion section, Oleothorax, Pneumoperitoneum, Phrenic paralysis, Phrenic evulsion, Extrapleural pneumothorax, Extrapleural pneumolysis, Thoracoplasty, and Cavity drainage (Monaldi) The method of choice is artificial pneumothorax, which can be most successful in selected cases, causes little discomfort to the patient, and requires no elaborate apparatus

Artificial Pneumothorax.—

Indications —

1 Early unilateral disease which is not responding to bed-rest

2 Bilateral disease, providing that one lung is only slightly affected If necessary, a bilateral pneumothorax may be performed, beginning as a rule with the more severely affected lung

3 Cases of hæmoptysis, if bleeding persists, providing that the lung from which the blood is coming can be determined

4 Cases of tuberculous pleural effusion, where fluid may be withdrawn and air introduced in its place ('air-replacement')

5 Some cases of localized tuberculous pneumonia

6 Pregnancy—if the woman is to be allowed to go to 'full-term' an artificial pneumothorax will safeguard a slightly affected lung, by preventing undue strain

Principle—A known amount of air is introduced into the pleural cavity by a special apparatus, and refills of air are given at suitable intervals, thus forming an 'air cushion' This air cushion rests the lung by restricting its expansion and allowing the diseased area to contract

There are various kinds of pneumothorax apparatus on the market (e g, the Lillingston Pearson, working with syphon bottles, Chandler's apparatus, Heaf's portable apparatus,

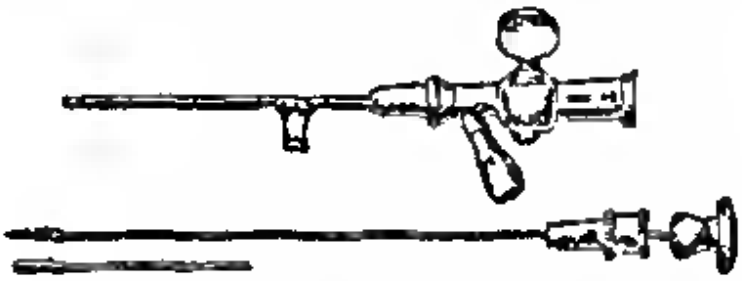

Fig 15—Rivière's induction needle for artificial pneumothorax.

and Maxwell's portable box), but the principle is the same in all of them, i e, they allow air to enter the pleural cavity without pressure The air is not pumped or forced in, but the patients draw it in with each inspiration Every nurse should familiarize herself with the type of apparatus in use at her own hospital so that she can keep it in good working order and assist the doctor during the actual procedure

Lay-out of trolley *Top shelf*—Sterile induction needle (there are various types, one of which is illustrated in *Fig* 15), a 2-c c hypodermic syringe and assorted needles, methylated ether, methylated spirit, iodine, sterile water, novocain 2 per cent, a bowl of sterile swabs and a towel, collodion, and the 'A.P' apparatus *Lower shelf*—a receiver for dirty swabs, a sedative cough syrup, a stimulant, a medicine glass, a writing pad or special A P card

Procedure—No special preparation is necessary for the patient, though some doctors like an injection of morphine to be given half-an hour before the induction The nurse closes windows and doors and screens off the patient if he is not in a single room. She then removes the patient's pyjama coat and all the pillows, with the exception of one which she places beneath the patient's chest as he lies on his side, the side of the chest to be operated on is uppermost and the arm on that side is kept well out of the way of the operator A suitable area of the chest is then cleansed in the usual way (The nurse will reassure the patient, and if he has a cough she may give him a dose of sedative cough mixture to prevent coughing during the operation) Taking all aseptic precautions, the doctor places a sterile towel over the patient and injects a local anæsthetic between two of the ribs (If the novocain is contained in a rubber capped bottle, it is important that the nurse should see that there is a special needle kept for insertion into it and a fresh one used for injection into the patient, a needle is blunted when pushed into rubber) The doctor then connects the special pneumothorax needle to the apparatus by rubber tubing, introduces the needle into the pleural cavity, removes the stylet, turns the stopcock, and reads the intrapleural pressures shown on the manometer The pressure in the pleural cavity should be negative The apparatus is switched on and the patient instructed to breath naturally, air will then pass in slowly After 100 c c. have been given the apparatus is switched off and the pressures taken again, if still negative a little more air is given, 150–300 c c are given at the induction

The nurse records the initial pressure, amount of air given, and the final pressure The doctor withdraws the needle, cleanses the skin, and seals the puncture with collodion Following an induction, the duties of the nurse are important She should instruct the patient to lie still, place a pillow beneath his head and cover him warmly

A hot drink will be appreciated After half-an-hour she should help the patient to sit up if he wishes to do so, and arrange his pillows comfortably He should be on absolute rest writing, handicraft, and smoking should be forbidden for that day at least and for as much longer as the doctor deems advisable A sedative cough mixture is often given p r n for the first few days If the lung has inadvertently been pricked by the needle there may be a little blood-stained sputum as a rule this is of no consequence and the patient should be reassured on that point by the nurse

Immediate Complications —

1 *Air embolism* this is due to the needle having penetrated the lung and having possibly punctured a pulmonary vein and bronchus Air passes into the circulation, and the patient may faint or show signs of paralysis Death may take place immediately or within a week, or the symptoms may subside and the patient recover

2 *Pleural shock* this is believed to be due to hypersensitivity of the pleura The patient may faint or have an epileptiform seizure This complication is said to be prevented by adequate anæsthetization of the pleura

Both these complications, especially the second, are happily very rare

Later Complications —

Pleural effusion this occurs in over a third of all patients If the effusion is very small it may not give rise to any symptoms and only be recognized by 'screening' or X-ray examination, it is not necessarily harmful and may serve to keep the lung at rest Refills may not be needed until the fluid has absorbed

A larger effusion may cause dyspnœa and general malaise, in which case fluid may need to be aspirated and the artificial pneumothorax may or may not be re-established Details of the treatment of pleural effusion are given in the chapter on COMPLICATIONS OF PULMONARY TUBERCULOSIS

Refills—The technique for refills is similar to that for inductions as far as the nurse is concerned She should record on the card the details as before The needle used may be a different one, either Saugmann's refill needle (*Fig* 16) or the Morland needle (*Fig* 17) according to the

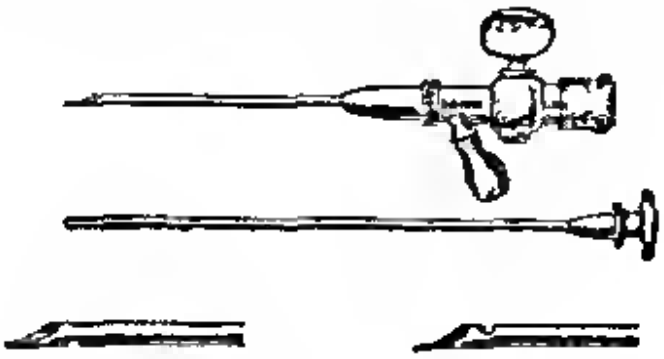

Fig 16—Saugmann's refill needle.

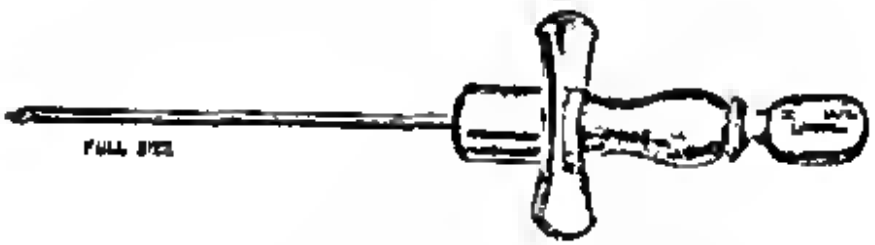

Fig 17—Morland's refill needle.

doctor's preference There should be no danger of damaging the lung at a refill because there is now a definite space between the layers of pleura The first refill is given on the day following the induction, rather more air being introduced The patient may resume his normal position in bed immediately afterwards, but should be helped by the nurse and made comfortable The next day no refill is necessary, the following day one will be given, after the second refill two days are allowed to elapse before the next one

The patient is usually 'screened' and an X-ray picture taken after about 1000 c c of air in all have been given, when the appearance of the lung will determine the amount and frequency of subsequent refills Some doctors omit the local anæsthetic after the first few days

The length of time the patient is kept in bed depends on his general condition and the wishes of the doctor In the opinion of the writers it appears that there is less risk of an effusion if the patient is kept at rest for some weeks An artificial pneumothorax may be maintained for months or years, and the patient may in due course resume his employment and continue to have refills at regular intervals Periodic X-ray and routine examinations are essential

During the course of an artificial pneumothorax a mediastinal hernia may occur this is a protrusion of the pleura across the mediastinum to the other side of the thorax Usually it contains no air and no anatomical structures as in herniæ in other regions as a rule, it reduces itself spontaneously

Adhesion Section —Adhesions are bands of fibrous tissue *radiating from the lung* and *causing it to adhere* to the chest wall Their presence may mean failure of an artificial pneumothorax if they are situated in such a position that the diseased part of the lung is prevented from collapsing Modern surgical methods can, in many cases, overcome this drawback and convert an inadequate pneumothorax into a 'selective' collapse

Preparation of the Patient —A refill (slightly larger than usual) is given shortly before operation The patient's skin is prepared in the customary manner, the whole of the affected side of the chest being shaved The final application *may be of iodine, picric acid, or flavine as ordered* Enemata, purgation, and starvation are considered unnecessary by most surgeons, as the operation is performed under local anæsthetic Premedication is given half an-hour or one hour beforehand, the injection commonly favoured being omnopon gr $\frac{1}{3}$ with scopolamine gr $\frac{1}{150}$, some surgeons like this to be preceded by nembutal gr $1\frac{1}{2}$

Procedure —The patient lies on the operating table in the lateral position with the side to be operated upon uppermost the skin is given a final cleansing and the local anæsthetic

injected into the required area The thoracoscope—a cylindrical tube containing prismatic lenses—is introduced through a small incision into the pleural cavity and the electric light switched on, making the adhesions visible to the eye of the operator (thoracoscopy) If the adhesions are considered suitable for cutting, a diathermy electrode is introduced either through the existing aperture (if the thoracoscope is of the 'operating' type) or through another incision The adhesions are enucleated from the chest wall and not cut at the lung end, to avoid possible damage to pulmonary tissue, the cut ends are usually sealed by a coagulating high-frequency electrode Clips are inserted to close the wound or wounds, these are removed on the third or fourth day A refill of air is usually needed shortly after operation

Some of the modern thoracoscopes can be sterilized by boiling, otherwise carbolic 1–20 is used

On return to bed, the patient is nursed in the lateral position, lying on the sound side, for twenty-four hours, unless the surgeon orders otherwise Emphysema (air in the tissues) may occur in varying degrees, especially if there is much coughing, and may cause some temporary discomfort (The patient should be instructed to place his hand over the wound when coughing, and to try to restrain the cough as far as possible) The nurse should pay particular attention to the colour of the patient and to the pulse-rate and volume in case of hæmorrhage, but this complication is comparatively rare

An X-ray photograph is taken shortly after adhesion section to determine the degree of collapse now present, upon this factor depends the amount of air to be given at subsequent refills Most operators like to screen the patient before and after operation

Very dense adhesions which are not divisible by the above method may require an operation of 'thoracotomy', which involves a small rib resection pre-operative and post-operative care are as described above

Oleothorax —The injection of oil instead of air into the pleural cavity is a measure occasionally taken It is used most commonly following a pleural effusion where the presence of adhesions are likely to make it impossible to induce (or re-establish) an artificial pneumothorax The oil used is either gomenol, which is alleged to have an inhibiting action on the growth of the tubercle bacillus (made up in paraffin or olive oil), or plain paraffin oil The oil must be sterilized before use by heating for twenty minutes at 150–170° C and inserted at blood heat

The pleura is anæsthetized in the usual way and from 2–5 c c of oil are injected into the pleural cavity by means of an ordinary glass or glass and-metal syringe and an intramuscular needle (The nurse must provide a wide-bore needle for drawing up the oil) The amount instilled at subsequent refills is determined by 'screening', as much as 200–500 c c may be given at one stage later in the course

Pneumoperitoneum —*This differs from* a pneumothorax in that air is introduced into the peritoneal cavity instead of into the pleural cavity, the object is to raise the diaphragm, restrict its movement, and thereby rest the lung It is performed in carefully selected cases, especially where a cavity is near the mediastinum, and is usually combined with an operation to paralyse the phrenic nerve, which will be described later

Procedure —No special preparation is needed, the patient lies on his back with one pillow beneath his head The nurse should make sure that he has emptied his bladder recently

The doctor cleanses the skin of the abdomen and introduces air into the peritoneal cavity, using the same technique and apparatus as for pneumothorax As much as 500 c c may be given initially, and 800–1000 c.c at refills After the induction, the patient should lie in the recumbent *position for twenty-four hours* *Some surgeons like a small* sandbag placed on the abdomen or a firm binder applied

Phrenic Paralysis —

Indications —

1 As an alternative to an unsuccessful artificial pneumothorax

2 In some cases of artificial pneumothorax, especially where the base of the lung is adherent to the diaphragm

3 In cases of hæmoptysis, with or without pneumothorax

4 As an adjunct to pneumoperitoneum.

Principle —By paralysis of the phrenic nerve the diaphragm on that side rises, sometimes as *much as 6 or 7 cm*, and remains stationary, thereby limiting the expansion of that lung

Preparation of Patient —No special preparation is necessary the neck and upper part of the chest on the affected side is shaved and cleansed in the usual manner An injection of morphine, gr ¼ with atropine, gr $\frac{1}{150}$, or omnopon, gr ½, with scopolamine, gr $\frac{1}{150}$, is usually given half to one hour prior to operation.

Method —The skin receives a final cleansing and local anæsthetic is injected above the clavicle An incision is made and the phrenic nerve located and separated from the tissues Part of it is then crushed with artery forceps The wound is sutured or clipped

There is no special post-operative treatment If the patient has been allowed up previously, he may be permitted to visit the toilet on the day following operation

Phrenic Evulsion.—This operation produces permanent paralysis of the diaphragm the phrenic nerve on the affected side is cut and several inches removed

Now a days most surgeons prefer to crush the nerve instead of cutting it, the consequent paralysis is then only temporary, lasting from four to six months, after which time the paralysed side of the diaphragm becomes active again If necessary, the operation can be repeated The degree to which the diaphragm has risen can be seen on 'screening' or on taking an X-ray photograph

N.B—One great disadvantage of a *phrenic evulsion* is noticeable if the patient should require a thoracoplasty later—the paralysis diminishes the cough reflex and therefore such an operation might be dangerous owing to the inability to expel secretions

Extrapleural Pneumothorax.—This operation has not justified its early promise, but is occasionally performed in selected cases The pre-operative treatment is similar to that for adhesion section

Procedure—The operation is performed under a local anæsthetic as a rule, through a posterior incision, a portion of the 4th rib being excised with portions of adjacent ribs if necessary Both layers of pleura are stripped, thus separating the lung from the chest wall, and the resulting space is filled with air Frequent refills will be necessary at first Should a blood-stained effusion occur it will require aspiration.

After-care varies according to the wishes of the individual surgeon Aspiration, with air replacement, is done if fluid is present

Extrapleural Pneumolysis—This operation is rarely used to day, therefore a brief description of its principles will suffice

The parietal pleura is separated from the chest wall over a limited area of lung surface The collapse is rendered more permanent by introducing into the extrapleural space some foreign substance, e g , paraffin wax, omentum from another patient, muscle tissue, or (in women) fat from the breast This process is known as 'tamponage' When the operation is modified for an apical lesion it is known as 'apicolysis', and the apex is freed through the extrafascial layers many surgeons do this during the first stage of every thoracoplasty

Thoracoplasty.—This is the most permanent form of collapse therapy, and is a major operation attended by some risk, though the mortality figure is now remarkably low

Preparation of the Patient—It is advisable for the patient to be admitted to the surgical ward some days before the operation in order that he may become accustomed to the routine and to the staff He should be in as good physical condition as possible and should rest in bed for at least a week prior to operation, during this week diet should be generous, with the addition of glucose An expectorant is given for several days to enable the patient to empty his lungs of as much secretion as possible He is weighed and his blood sedimentation rate measured and charted The vital capacity (see chapter on SPECIAL TESTS) is measured daily in many cases

The whole of the chest is shaved and cleansed as for other bone operations In the case of a nervous patient a sedative may be necessary the night before the operation An enema is usually given, followed on the morning of operation by a rectal wash out if avertin is to be given Early tea and a small piece of toast is permissible

Premedication will be ordered by the surgeon or anæsthetist, and will often consist of omnopon, gr ½, with scopolamine, gr $\frac{1}{150}$, two hours prior to operation, sometimes followed by omnopon, gr ½, an hour later alternatively morphine, gr ½, with atropine, gr $\frac{1}{150}$, may be given

The anæsthetic may be entirely local, a large amount of novocain or decicain being necessary, or it may be general or a combination of both, in nervous patients avertin, given in bed, is necessary cyclopropane preceded by intravenous pentothal sodium is now in common use

Procedure—There are three main types of operation—those recommended by Semb, O Brien, and Sauerbruch—with various modifications the details of these need not concern the nurse Some surgeons like the patient to have an intravenous saline followed by 1–2 pints of blood during and after the operation

A long, curved incision is made posteriorly, the surgeon will have decided how many ribs or portions of ribs will

need to be removed to ensure a good collapse of the affected part of the lung In many cases, 3–4 in of nine or ten ribs are removed, from the junction of the vertebræ The operation is performed in two or three stages, three or four ribs being removed at one stage Occasionally, if collapse is still insufficient, an auxiliary stage is necessary, an inch or two more of several ribs being removed

Post operative Care—This varies considerably with individual surgeons The following is a summary of the points usually emphasized The patient is returned to a warmed bed, in a warm room free from draughts A rectal saline is given, unless the patient has had an intravenous infusion The pulse is taken and charted frequently until its rate has returned to normal and remained there for four hours As soon as possible, having regard to the type of anæsthetic used and the degree of shock present, the patient is placed in an upright sitting position Special beds which can be wound up and down at the head and middle are used when procurable Particular care must be taken by the nurse to see that the spine is kept straight, more especially the cervical spine It must be remembered that the 'pull' of the chest muscles and shoulder muscles will not now be equal A pulley may be devised from the foot of the bed so that the patient may, as soon as he is able, help to pull himself up and maintain a good position. Hot sweet fluids are given as soon as possible to combat shock, about three to six hours after operation, and the patient may have light diet as soon as he feels able to take it. An expectorant mixture is given four hourly and the patient encouraged to get rid of all secretions He must not suppress his cough, but while coughing the nurse should place her hands firmly on the affected side, thus giving him adequate support.

The doctor will probably order a sedative for the night as there will be a certain amount of pain large doses of morphine are not usually given as they tend to dry up the

secretions More pain is felt after the second stage than after the first

The wound is usually dressed on the day following operation, and elastoplast re-applied firmly over a large pad under the axilla, strapping from front to back Providing the temperature and pulse-rate are normal and there is no hæmorrhage, the dressing is then left undisturbed until the eight or ninth day, when the sutures are removed

For at least the first three days the patient will be on absolute rest and will need to be washed by the nurse The length of time he remains in bed varies according to his condition and to the custom of the hospital, but generally speaking it is thought advisable for him to take a little exercise, such as visiting the toilet, as soon as possible, i e , after ten to fourteen days While in bed the usual nursing attention must be paid to mouth and pressure points The vital capacity may be measured daily Postural exercises are usually given, the patient lying first on his back and then laterally for certain periods of the day, with a small sand-bag or bag of shot on the affected side the weight is increased gradually until 15lb can be tolerated on the chest for as long as half an hour (*N B* The use of weights is not approved by all surgeons)

After the final stage, three month's bed rest is advisable, apart from visits to the bathroom

It is the nurse's duty to familiarize herself with the wishes of the surgeon and to carry out his instructions to the letter

Particular care must be taken to see that the patient moves the arm of the affected side , if this is done full movement will be regained in a remarkably short time In some hospitals exercises are given by a physiotherapist from the fourth day for shoulder and chest muscles, beginning with four minutes of gentle exercise and gradually increasing the length of time and the vigour of the exercises The patients in most modern hospitals and sanatoria perform

these exercises in front of a large mirror, which shows them any faults of posture and helps them to correct them The bugbear of deformity is not nearly so formidable these days, the large majority of patients having quite a good figure and regaining full use of all muscles in a short time

The ideal period between stages of the operation is two to three weeks, but this period may have to be lengthened if complications occur If too long a period is allowed to elapse, the ribs will have commenced to regenerate

Complications —

1 *Spread of Disease* This is diagnosed by persistence of fever, and later by the X-ray picture, which shows increased shadowing A prolonged period of bed rest will be necessary

2 *Atelectasis*, or massive collapse, may occur during the first four days after operation The affected lung on radiological examination appears to be 'blacked-out' This is commonly due to blockage of a bronchus by secretions There will be a persistent high temperature and increased pulse-rate with dyspnœa postural drainage is sometimes useful, but the prognosis is poor This complication may often be prevented by encouraging the patient to get rid of secretions

3 *Sepsis* Secondary infection may occur, and may be superficial or deep, energetic measures will need to be taken if another stage is to be performed with safety A swab is taken to determine the infecting organism and penicillin or the sulphonamides may be required Even a superficial infection of the skin around the wound, producing 'septic spots', will delay the next stage, therefore all aseptic precautions must be taken with regard to dressings, etc, to prevent the occurrence of such a condition Should a large superficial hæmatoma occur after operation it will require to be aspirated under strict aseptic conditions

Cavity Drainage (Monaldi).—This, in itself, is not a complete form of collapse therapy but is sometimes used

in preparation for a thoracoplasty which could not otherwise be attempted It is used in cases where there is a large intractable lung cavity containing air and secretions The air is unable to escape from the cavity though more is taken in, consequently the pressure rises and the size of the cavity increases, with further involvement of surrounding lung tissue

In Monaldi's operation the skin is cleansed and anæsthetized and a small incision made anteriorly, through this a trocar and cannula is inserted between the ribs, the cannula being attached by rubber tubing to the artificial pneumothorax apparatus When the cavity is reached a positive 'swing' will usually occur, if it does not, the cannula may be blocked with secretion When the surgeon is satisfied that the instrument is in the cavity, he introduces a rubber catheter through the cannula into the cavity The cannula is then removed and a safety pin put through the catheter, which is fixed to the skin by means of narrow strapping, over a special perforated rubber disk.

The patient is then X rayed, if the catheter is safely in the cavity the patient is returned to bed and the catheter connected by means of tubing to a bottle and electric suction pump worked by a motor, which can be switched off and on as ordered A specimen of the fluid in the bottle will be sent from time to time to the pathological laboratory The nurse's duty is to see that the connexions, tubing, and bottle are kept clean and in good working order and that the patient is as comfortable as possible

If at any time the contents of the drainage bottle become blood stained, the electric motor should be switched off immediately, after one or two days it may be restarted with caution

Before this operation can be performed it is necessary to make sure that the pleural cavity is obliterated by adhesions, otherwise the lung is liable to collapse and a pyopneumothorax develop If there is any doubt, an

artificial pneumothorax is attempted and should an intrapleural space be found it is obliterated by the introduction of silver nitrate

The operation for cavity drainage is always performed through an anterior incision, the sinus which usually results will not then interfere with the performance of a subsequent thoracoplasty, which is carried out posteriorly

CHAPTER XI

COMPLICATIONS OF PULMONARY TUBERCULOSIS

THOSE described are (1) Dry pleurisy (2) Pleurisy with effusion, (3) Tuberculous empyema, (4) Spontaneous pneumothorax, (5) Bronchopleural fistula, (6) Tuberculous laryngitis, (7) Enteritis, (8) Ischiorectal abscess, (9) Tuberculous meningitis, (10) Amyloid disease

1 **Dry Pleurisy**—In this condition the pleura becomes inflamed and the two layers rub together, causing pain which is especially acute when the patient takes a deep breath or coughs The temperature and pulse-rate may be raised, and there will be varying degrees of dyspnœa Adhesions are likely to form, thus marring the success of a subsequent artificial pneumothorax

Treatment —

a Application of counter irritants, e g, iodine painted over the affected area This will only relieve the mildest form of pleurisy

b Heat to the part, applied by means of a poultice, e g, antiphlogistine or cataplasma kaolin.

c Strapping the chest This is the best treatment in most cases, providing the strapping is properly applied Every nurse should know the correct method, therefore the procedure will be described in detail Four or five strips of zinc oxide adhesive plaster 2½ in wide should be cut and hung conveniently from locker or table so that they do not twist, each strip should be long enough to reach from 3 in beyond the sternum, round the affected side, to 3 in beyond the vertebræ The patient sits upright The skin should be clean and all hairs removed with a sharp razor The nurse instructs the patient to

breathe in and then out, and at full expiration she applies the first piece of strapping around the base of the chest, she repeats her instructions to the patient before applying each strip, making quite sure that the actual application is made when the lungs are in full expiration The second strip is placed slightly higher than the first, overlapping it by 1–1½ in, the third should overlap the second, and so on until the affected side of the chest is completely covered A vertical strip over the ends of the plaster may be necessary to keep them in place

2 **Pleurisy with Effusion**—This is Nature's method of relieving the pain of dry pleurisy An exudate forms between the pleural layers, thus separating them and preventing friction If the effusion is a large one, there will will be some degree of malaise with fever and increased pulse-rate, dyspnœa is the most troublesome symptom and its severity will depend on the size and position of the effusion. On percussion, dullness is found and reduced breath-sounds The fluid is visible on the fluoroscent screen

Treatment—Aspiration of the fluid may be undertaken (*a*) to relieve dyspnœa, and (*b*) for diagnostic reasons The technique of closed aspiration is the same in both cases Aspiration may be performed with a large syringe or a special aspirator the nurse must be able to prepare the trolley for either

Method 1 Using a glass or glass and metal syringe

Top shelf Sterile bowls, receivers, sterile swabs and towels, methylated spirit, ether or iodine, and sterile water, a large syringe (30–50 c c), a long exploring needle and a two-way tap fitting with rubber tubing (*Fig* 17), a 2 c c hypodermic syringe and assorted needles, local anæsthetic, collodion, and a sterile specimen tube

Lower shelf Graduated measure jug, receiver for dirty swabs, sedative cough medicine, a stimulant, and medicine glasses

Procedure The patient may sit upright with the arm on the affected side supported and out of the way of the operator, or, if breathing is not unduly distressed, he may lie in the semi recumbent position with the hand and forearm on the affected side placed under the chest to raise it If the patient is ambulant he may sit astride a chair and lean forward on to a padded couch, and the aspiration be performed from behind The doctor percusses the chest, cleanses the skin, and introduces the local anæsthetic over the area of maximum dullness, the two-way tap is then fitted on to the large syringe, the aspirating needle is attached to one arm of the tap, and to the other arm is fixed the rubber tube (*Fig* 18) with its free end dipping into the measure jar

Fig 18.—Aspirating syringe with 2 way cock

The doctor then inserts the needle into the anæsthetized area and pushes it on into the pleural cavity He pulls the piston gently and if the needle is in the fluid some will be drawn up into the syringe When the syringe is full the tap is turned so that on pushing home the piston the fluid is ejected, via the other tap-arm, into the measure jug (The use of a two-way tap facilitates the operation without it the syringe must be disconnected from the needle each time it requires to be emptied) If a specimen is required this should be obtained first, to avoid contamination, it should be received directly into the test tube, which is held under the ejecting arm of the tap When the doctor has aspirated as much fluid as he thinks necessary, he will withdraw the needle and clean the skin the puncture should be sealed with collodion. The nurse should note how much fluid has been withdrawn and record the amount on the patient's chart

Throughout the proceeding the nurse must be ready to to help the doctor in any way possible, and with a little practice she will learn to anticipate his wants, at the same time she must watch the patient carefully in case of faint ness, and keep him as comfortable as possible The speci men tube must be labelled with the patient's name (surname and initials), the name of the ward, the date, and the nature of the specimen the nurse must see that it is taken to the laboratory without delay

Method 2 Using a special aspirator

There are several types of aspirator, the Potain will be briefly described here, as, although considered by some people to be 'old fashioned', it has stood the test of time, is in constant use in many hospitals, and for aspiration of large effusions is more reliable than some of the more modern types of apparatus *Fig* 19 illustrates the Potain aspirator A vacuum is created in the glass bottle W by use of the suction pump P, while P is in use the tap T_1 is open T_1 is then closed and the cannula C introduced into the pleural cavity, the trocar is removed or withdrawn sufficiently, tap T_1 is opened, and fluid will be drawn through the rubber tubing into the 'Winchester', its progress will be seen through the glass connexion G *If* the fluid ceases to flow, the trocar is pushed gently through the cannula to clear it, taking care that T_2 is closed From time to time, air will need to be withdrawn from W, to do this T_2 is closed, T_1 opened, and P used vigorously At the termination of the operation the cannula is with drawn, the skin cleansed, and the puncture sealed with collodion.

A local anæsthetic is used and the patient may adopt either of the positions mentioned in Method 1

N.B—If it is desired to replace some of the fluid by air an artificial pneumothorax needle and apparatus will be required, the doctor will introduce air into the pleural cavity in the usual way but not into the site of aspiration,

the needle will be inserted at a higher level to avoid any fluid which may remain

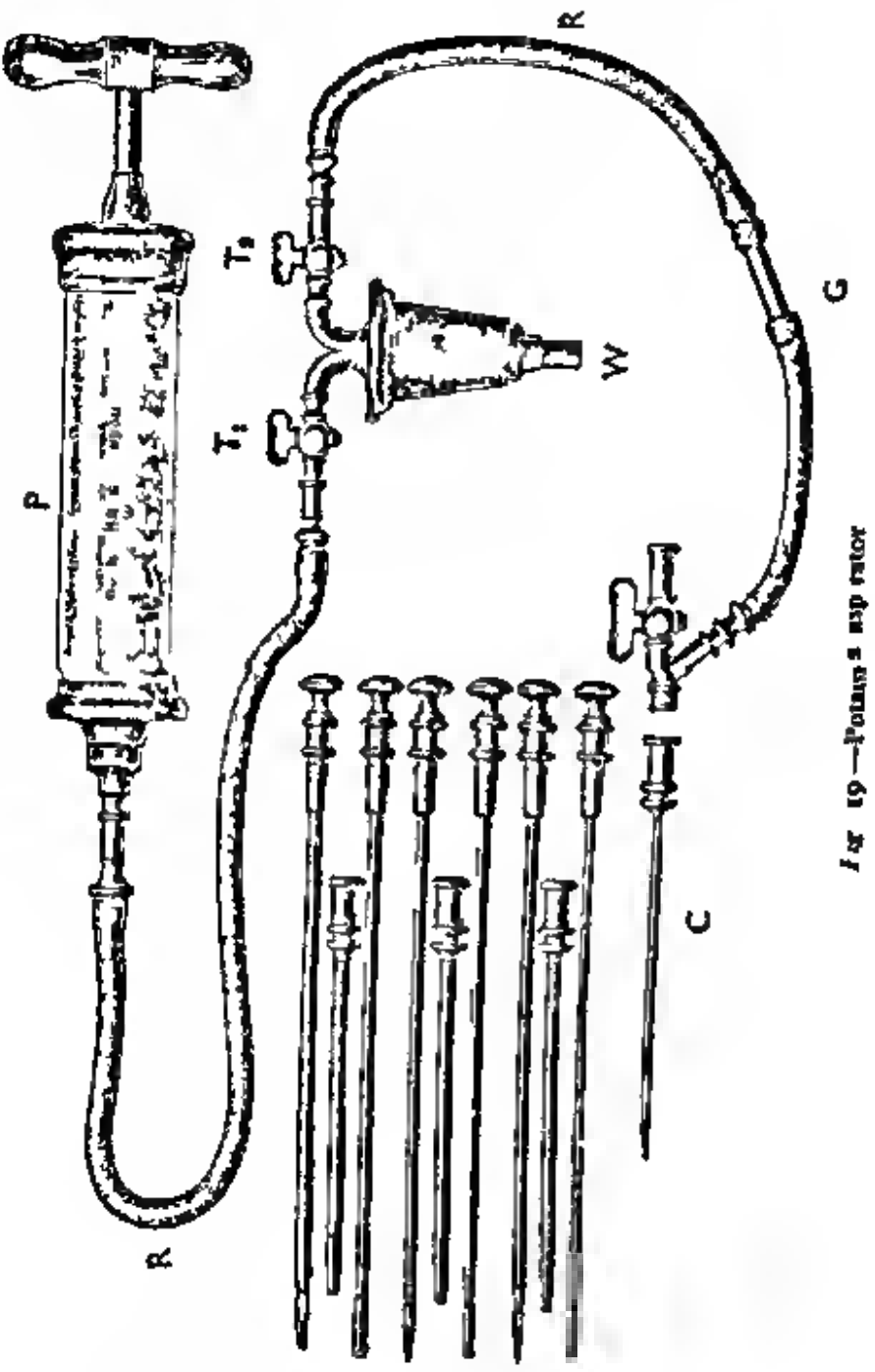

Fig. 19.—Potain's aspirator

3. **Tuberculous Empyema.**—Thin fluid may become purulent, and the pleural cavity filled with greenish pus, if this follows an artificial pneumothorax it is known as

pyopneumothorax Although the pus is tuberculous in origin it may contain other organisms if the organisms are sensitive to penicillin this may be tried, it should be emphasized, however, that penicillin has no effect on the tubercle bacillus

Treatment—*Thin pus may be aspirated with or without* the instillation of some antiseptic fluid such as azochloramid-T, which has been tried with varying degrees of success More usual measures are —

a Intercostal Drainage For treatment of a mixed infection a de Pezzer or Malecot catheter is introduced between the ribs through a cannula and the free end of the catheter is connected to a piece of rubber tubing the distal end of which is fixed to a long glass tube A cork having two holes is placed in a glass bottle containing a measured amount of water, the glass tube is pushed through one of the holes with its end under the water ('under-water drainage') Air and pus can then flow down the tube and into the bottle which must be emptied and cleaned daily, the amount of fluid being carefully measured

b Rib Resection This operation is performed in the theatre under a local anæsthetic. A portion of rib is removed and the pleural cavity inspected, clots are removed, and a flanged tube is inserted *Pleural* wash-outs may be carried out daily after rib resection, saline, eusol, or Dakin's solution being used *They are given very gently through* the tube, one funnelful at a time If performed carelessly the procedure may endanger the patient's life, therefore the nurse must pay particular attention to the following points (i) a small funnel and fine catheter must be used, (ii) the lotion must be warm but not hot, (iii) the funnel must never be held higher than 1 ft above the patient's chest so that the fluid is not forced into the wound, (iv) air must *never* be allowed to enter Neglect of these points may cause *an embolus in the blood stream*, particularly where there is much granulation tissue around the wound—

such an embolus may reach the brain and death or permanent paralysis ensue

4. **Spontaneous Pneumothorax.**—When this occurs in a case of tuberculosis it is usually due to the rupture of a diseased portion of visceral pleura and underlying lung tissue, air thereby escaping from the lung into the pleural cavity, with every breath more air enters the cavity, and if it cannot escape, the pleural cavity becomes filled with air (tension pneumothorax) It can occur in patients who have had no active treatment, and in those who have had an artificial pneumothorax, in the latter case it may be due to the sudden snapping of an adhesion over the diseased area The signs and symptoms of a true tension pneumothorax are dramatic and easily recognized, the patient complains of very severe pain in the chest, with acute dyspnœa and usually cyanosis

Treatment—This is urgent, and is performed by the removal of air, the doctor being informed immediately He will, with all speed, introduce an artificial pneumothorax needle into the pleural cavity and will withdraw several hundred cubic centimetres of air, using the artificial pneumothorax apparatus Every nurse should understand how to adjust the particular apparatus in use at her hospital so that air can be removed instead of introduced When a negative pressure is shown on the manometer (or at least, one which is only slightly positive) the doctor will withdraw the needle The patient is instantly relieved when air is withdrawn. Most medical men will agree that if the patient is becoming cyanosed and literally 'fighting for breath' and the doctor is not immediately available, it is within the province of the sister or nurse-in-charge of the ward to introduce a large needle (preferably an artificial pneumothorax needle) as this may save the patient's life In such a case, the nurse will know when the needle has entered the pleural cavity by the hiss of the escaping air, if possible she should then attach a piece of rubber-tubing to the needle

and place the other end of the tubing under water in a bowl, she will see by the bubbles that air is passing out into the water and by this method there can be no backward flow of air Speed is the main point, and she should not waste time by giving a local anæsthetic

The doctor will reinsert the needle if the patient again becomes breathless, and in some cases the needle has to be left *in situ* (strapped to the chest) and attached to a long piece of rubber tubing which passes into an under-water drainage bottle When the bubbles cease the needle may have slipped out of the pleural cavity and require adjusting, or it may be that the 'leak' has healed and the lung has begun to re-expand the needle is not removed without the doctor's permission A 'slow' spontaneous pneumothorax does not give rise to such dramatic symptoms as does a tension pneumothorax and may only be suspected by the presence of slight dyspnœa and recognized by taking the intrapleural pressure, which will be found to be positive This type is probably due to the fact that the perforation is only a very small one, or that air can by some means find its way out of the pleural cavity and be absorbed or expired, but this occurs rarely

5. *Bronchopleural Fistula*—When fluid or pus is present in the pleural cavity and a perforation occurs in the visceral pleura, pleural fluid passes through the aperture into the lung, entering a bronchus Pleural fluid will be coughed up This condition is known as a bronchopleural fistula and is an extremely unfavourable condition The nurse, if observant, will notice this change in the character of the sputum and will report it. To prove the presence of the fistula a small amount of a violet dye is injected into the pleural cavity, if coloured fluid is subsequently expectorated there is definitely a fistula This is a serious complication, drainage is sometimes tried, but the prognosis is poor, though more cases recover now than ten years ago

6 **Tuberculous Laryngitis**—The larynx may readily become infected if the sputum contains tubercle bacilli There may be infiltration and sometimes ulceration of the vocal cords, epiglottis, and arytenoid cartilages The earliest symptom is hoarseness, this is unaccompanied by pain and is therefore often ignored or explained away by a 'cold' or the vagaries of the climate A nurse should always report the fact that a patient is hoarse Later there may be œdema and considerable pain and difficulty in swallowing (dysphagia)

The larynx is examined in a darkened room by means of a special head lamp, many doctors prefer to anæsthetize the larynx with a cocaine spray before attempting to examine The operator holds the patient's tongue firmly with a piece of lint in the left hand, while with the right he introduces the laryngeal mirror

Tray for laryngeal examination —

Laryngeal mirrors
Bowl of warm water
Pieces of lint or old linen (to hold tongue)
Head lamp
Spirit lamp (to heat the mirrors and thus prevent clouding)
Receiver

Treatment—As the patient's general health improves so the larynx will improve, therefore general methods to improve the resistance of the patient are essential Locally, rest is considered the best treatment, silence is thus advised and the patient has a pad and pencil beside him on which to record his requests and answers to questions put to him If a patient finds complete silence very irksome he is sometimes permitted to whisper, but even this causes some strain to be put upon the larynx Inhalations may sometimes have a soothing effect, e g, a solution of creosote may be sprinkled on to a metal mask (Burney Yeo), which is worn by the patient for fifteen minutes twice or thrice daily

alternatively, a drachm of menthol or tinct benzoin co is added to a pint of boiling water and the steam inhaled, using a Nelson or Maw's inhaler or a jug Lozenges are often helpful, troch pot chlor or troch phenol may allay irritation

Treatment of resulting dysphagia The diet must be adapted to suit the needs of each patient Some will find fluids and semi solids such as jellies, junkets, custards, etc., easier to take than solids, others may find great difficulty in swallowing fluids The throat may be sprayed with an analgesic substance such as orthoform powder or cocaine before each meal, the patient may do this himself, inhaling the powder from a watch glass by means of a Leduc's tube, or the nurse may make the application with a throat spray, remembering to wear a mask for her own protection Some patients with acute dysphagia are only able to take a meal if the throat has been thus sprayed beforehand In less severe cases, a cocaine lozenge sucked slowly before a meal may prove beneficial If there is difficulty in swallowing fluids, the patient may try drinking through a straw or glass tube while lying on his side or on his face, with a little experiment he may find a position which facilitates swallowing In some cases the superior laryngeal nerve on the side most affected is injected with alcohol

Recently, the application of an electric cautery to the edge of the tuberculous ulcer has been tried with some success

7. *Tuberculous Enteritis* —This is a common complication and is thought by many doctors to be caused by the swallowing of infective sputum

The symptoms are diarrhœa, pain of varying degree, vague abdominal tenderness, and sometimes vomiting The stools may be offensive and contain blood and pus, according to the degree of intestinal ulceration

Treatment —Pain may be relieved by heat and counter-irritants, and by sedative drugs such as lead and opium pills Diarrhœa may be controlled by a bismuth and opium mixture The diet must be non irritating and fairly dry

spiced foods, roughage, and large quantities of milk should be avoided

Pneumoperitoneum is occasionally performed to help relieve the symptoms, but it has no curative value The ultimate result of an acute tuberculous intestinal infection is exhaustion and often death, sometimes from a perforation

8. Ischiorectal Abscess.—An abscess in the deep tissues of the ischiorectal region (the area around the anus) arises not infrequently in patients with pulmonary tuberculosis It is very much more common in men than in women.

The symptoms are like those of most abscesses, i e , pain in the affected region and a rise in temperature a hard, inflamed swelling will develop

Treatment—Hot baths, if practicable, are good, otherwise an antiphlogistine or kaolin poultice Fomentations are of little use unless very frequently renewed, a task which is often impossible unless the patient has a private nurse

If the abscess does not burst spontaneously it will have to be incised under a local anæsthetic (an ethyl chloride spray is most commonly used), and a gauze plug inserted Once the abscess begins to discharge, treatment is directed towards keeping the area as clean as possible and the wound open until the discharge has ceased Great care must be taken to ensure that the wound is not contaminated by fæces

If the patient is able to go to the bathroom, the treatment *par excellence* is a hot bath after evacuation of the bowels, followed by dettol swabbing and aseptic dressing of the wound eusol or flavine-and paraffin dressings are often used, while promanide jelly has been found most efficacious after the first few days If the patient is unable to take a bath, the area must be irrigated with Dakin's solution, eusol, or dettol after the bowels have been opened and before the clean dressing is applied The nurse should place the patient's buttocks on a mackintosh on the extreme edge of the bed, the mackintosh should hang down into a bucket, the irrigating fluid may be conveniently contained in a

douche-can to which rubber tubing and a catbeter are attaehed, the tubing may be pinched with the fingers to control the flow and the fluid allowed to run from the wound down the mackintosb into the bucket The dressing is kept in place by a T-bandage Although the use of spirit for cleansing has been recommended by some, the authors feel that this would cause acute discomfort to the patient, even one drop of spirit trickling on to the wound might give rise to extreme pain and therefore the nurse is not advised to use it unless specifically ordered

Treatment may bave to be continued over a long period if a sinus discharges persistently, as is often the case It will be noticed that the condition tends to clear up as tbe general eondituon of the patient improves Complete excision of the sinus is sometimes performed

9 **Tuberculous Meningitis**—This may occur without evidence of previous disease, especially in children, or it may be a complication of miliary or pulmonary tuberculosis Unlike cerebrospinal meningitis, the condituon is almost invariably fatal

The onset is slow, and in the case of a child there may be lassitude and minor changes in temperament for some weeks before the parents realise that the child is actually ill The first symptom to be noticed is usually headacbe, often accompanied by vomiting, photopbobia (intolerance to light) may also be marked The headacbe becomes more severe, with pain also in the back and neck. There may be bead retraction, particularly noticeable in children On examination, the pupils are usually unequal and there may be ptosis of one eyelid, the presence of a squint is common *Kernig's sign is positive*—i e, inability to extend the leg wben the thigh is flexed to a rigbt angle with the trunk. Tbe patient becomes drowsy and finally unconscious, there may be retention of urine, which fact should be reported, but more often there is incontinence of urine and fæces Fits may occur

Diagnosis is made by examination of the cerebrospinal fluid, obtained by lumbar puncture (This is explained fully in the chapter on SPECIAL TESTS) Occasionally, on careful examination, the doctor may see a tubercle on the retina of the eye

Treatment —There is, unhappily, no known cure, therefore treatment is directed towards relief of the symptoms and the general comfort of the patient He should be nursed in a quiet, darkened room The skin must be kept clean by frequent sponging attention must be given to all pressure points to prevent the formation of bed-sores Retention of urine will be dealt with by catheterization and incontinence by frequent changing of pyjamas and sheets

N.B —Persistent headache occuring in any patient with pulmonary tuberculosis is a suspicious symptom and the nurse should always report it

Post-mortem Examination —This will disclose tubercles over the course of the blood vessels of the brain and a sticky gelatinous mass covering the base of the brain The amount of cerebrospinal fluid present in the ventricles will be much increased Changes in the C S F are described in the chapter on SPECIAL TESTS

10. Amyloid (Lardaceous) Disease.—This is a complication which often occurs in conditions of long-standing sepsis, e g, secondarily infected empyema or any chronic discharging sinus, and there is no remedy for it It affects many organs, especially the kidneys, liver, and spleen, which become enlarged owing to the replacement of their tissues by a waxy substance Although amyloid disease may be suspected, it can only be definitely diagnosed by post mortem examination

Enlargement of the liver, together with a waxy appearance of the patient's skin giving a semblance of perspiration, are factors very suggestive of the presence of amyloid disease It is less prevalent now than it has been in the past

CHAPTER XII

ASSOCIATED DISEASES

1. **Bronchitis** —This disease often accompanies tuberculosis and is found most commonly in elderly persons and also in children The bronchi are affected, there is a 'wheezy' cough, and the sputum becomes frothy and abundant

2. **Bronchiectasis** —This condition is sometimes mistaken for tuberculosis Confusion may arise owing to the fact that hæmoptysis may occur in both diseases In bronchiectasis pus forms in a dilated bronchial tube and the resulting sputum is extremely offensive, if allowed to stand, the sputum appears to be made up of three layers—the lowest yellow (pus), the next greyish (mucus), and the top brown and frothy Clubbing of the fingers is marked The condition is difficult to cure, whether the patient has a tuberculous lesion or not Lobectomy or postural drainage may have some good effect (Bronchiectasis may occasionally be tuberculous in origin)

3. **Asthma** —This is not commonly found in sufferers from tuberculosis, though at the onset the bout of coughing with dyspnœa may occasionally be mistaken for it

During an attack the patient sits upright and gasps for air In 'allergic' asthma, the patient is hypersensitive to some substance, usually a foreign protein, by a series of careful tests and by the elimination of various proteins, the causative factor may be found

4 **Erythema Nodosum** —This condition was until a few years ago thought to be allied to rheumatism only and was treated accordingly, now it is believed to be often the manifestation of a tuberculous allergy in primary infection One authority has stated that "50 per cent of all tuberculous

patients give a history of an attack of erythema nodosum before the primary focus was discovered"

It is characterized by tender swellings (rather like gnat-bites) on the limbs, more especially on the legs, which feel 'heavy' when walking, there may be slight fever and general malaise Such a condition occurring in any person calls for an X ray photograph of the chest, to be repeated at intervals for several years

5. **Phlyctenular Conjunctivitis**—Small, raised, yellow blobs form on the conjunctiva, the cause is believed to be the circulation of tuberculous toxins Photophobia may be present and irritation may be severe Frequent irrigations with warm boracic lotion are helpful, and the patient's general body resistance needs to be built up Tuberculin is sometimes used with good results

6. **Diabetes Mellitus.**—Many patients in sanatoria are also diabetics The common association of the two diseases has not, so far, been explained satisfactorily, but it is probable in some cases that the patient's resistance has been so undermined by the diabetes that he is more susceptible to the tubercle bacillus The disease cannot be discussed in detail here, briefly, it is due to a deficiency of insulin (manufactured in the islets of Langerhans in the pancreas) which controls the combustion of sugar in the body If the patient is given injections of insulin and an adequate nourishing diet, according to modern standards of diabetic treatment, he may be safely treated for his tuberculosis

Some procedures may have to be modified, and a close watch kept on urine and blood-sugar content while treatment is being carried out.

7. **The Pneumonoconioses.**—These so called 'dust diseases' may be confused with, or in some cases complicated by, tuberculosis, or may predispose to it They are industrial diseases, and include the following —

a Silicosis—found in quarrymen, coal miners, tin miners, metal grinders, sand blasters, and pottery workers, a fine

dust, 'silica', is produced, which is inhaled into the lungs

b Bagassosis—found in workers in factories which use 'bagasse', a substance derived from broken sugar-cane, containing 60 per cent silica

c Asbestosis—found in asbestos workers and those in textile industries

d Byssinosis—found in cotton workers, spinners and carders of fine cotton are particularly affected owing to the presence of fluffy particles which blow about in the air

The 'dust diseases' give rise to a troublesome cough and shortness of breath, shadows are found on the X-ray film

Recent improvements in factory administration and working conditions have lessened the incidence of these diseases, for which financial compensation is now available

8. Lupus Vulgaris.—Lupus is the skin disease caused by the tubercle bacillus, it may be associated with tuberculosis of other parts of the body

It usually affects the face, and is a chronic disease found in persons of both sexes Small pinkish nodules form, the skin over them breaks down, and ulceration occurs More and more of the surrounding tissue becomes involved, healing may take place, but the resulting scar contracts, leaving a deformity Much destruction of tissue may occur, especially if the disease affects the nose or adjacent areas

Treatment formerly entailed excision of the parts Various drugs and ointments have been used with little success The patient's general health must be built up as far as possible Locally, the Finsen light or Kromayer or Lomholt lamp may be used with good effect, when healing occurs as a result of light treatment there is little scarring Chemical caustics, e g, CO_2 'snow', may be used in some cases, but should be applied only by an expert in this work.

9. Addison's Disease.—This disease of the suprarenal glands is nearly always tuberculous in origin The signs and

symptoms are pigmentation of the skin, muscular weakness, diarrhœa and vomiting, and a lowered blood pressure

Treatment is rest in bed a light nourishing diet, and injections of cortin or eucortin intravenously or intra muscularly The prognosis is poor

10 Lung Abscess —The signs and symptoms are sometimes mistaken for those of tuberculosis

The causes of lung abscess may be (*a*) pneumonia, (*b*) foreign body, e g, a tooth which has been inhaled during multiple extractions under nitrous-oxide anæsthesia, (*c*) blocked bronchus, and (*d*) pyæmia

The signs and symptoms are cough and sputum and a 'swinging' temperature Diagnosis is made by sputum test and X-ray photographs Treatment may comprise postural drainage, aspiration of the bronchus, and a course of sulphonamide therapy or penicillin.

CHAPTER XIII

SPECIAL TESTS

MOST of these tests are carried out in the pathological laboratory, but several, e g , the routine testing of urine and the measuring of the blood-sedimentation rate, are often undertaken by the nurse in the ward While many tuberculous patients may undergo various general tests, such as a complete blood count, only those tests which are peculiar to tuberculosis will be described here, with the exception of the routine testing of urine which is performed on the admission of any patient to hospital or sanatorium

All laboratory specimens should be clearly labelled with the patient's name (surname and initials), the ward, date, nature of the specimen, and the examination required

Example BROWN, J A , Ward 3, August 7, 1945
Pleural fluid
Exam req T B and O O (tubercle bacilli and other organisms)

1. Sputum —The patient is given a sterile glass container which has a well-fitting cork, he is instructed to expectorate into this on waking in the morning (If the sputum is scanty, a glass jar is kept by the patient for twenty-four hours and into this he expectorates all the sputum he can produce—this method is preferred by some doctors and in many sanatoria it is done as a routine for every new patient)

a Direct Smear —The container is sent to the laboratory The technician picks up a small amount of the viscid part of the sputum with a sterilized platinum wire loop and smears it thinly over a glass slide, which is then passed over the flame of a Bunsen burner to 'fix' the sputum to the slide The slide is then stained, using the

Ziehl Neelsen technique, as follows (i) hot carbol fuchsine (a red dye) is poured over the slide and allowed to remain for five minutes, (ii) the slide is washed in running water, (iii) 20 per cent sulphuric acid is poured over the slide and allowed to remain for two minutes, (iv) the slide is washed in running water, (v) the slide is immersed in alcohol for ten minutes

The tubercle bacillus is acid-fast and alcohol-fast. To distinguish it from other acid fast organisms which may be present the slide is 'counterstained', usually with methylene blue The slide is then examined under the microscope, if tubercle bacilli are present they will be seen as minute red rods, whereas other organisms will have been decolorized

b Centrifuged Deposit —If the sputum is scanty or the result of 'direct smear' examination has proved negative the sputum may be mixed with antiformin in a test-tube and the tube placed vertically in a centrifuge machine, which is set in motion The heavier part of the sputum sinks to the bottom this centrifuged deposit is then examined by the method described above

c Culture —If (*a*) or (*a*) and (*b*) have proved negative, it does not necessarily mean that tubercle bacilli are not present, they may be few in number and not easily found, therefore the specimen is 'cultured' The culture 'medium' on which tubercle bacilli will grow is known as Lewinstein's medium, this contains egg and is a modified and improved type of Dorset's egg medium, a thin layer of sputum is spread over a slope of the medium in a test tube and incubated at 37° C The tubercle bacillus grows very slowly and it may be weeks before colonies appear, these consist of yellowish-white spots which are examined microscopically to determine the exact nature of the organism

2. **Urine** —

Routine Test —Normal urine should NOT contain either sugar, acetone, albumin, blood, bile, or pus, and it should show the following characteristics —

Colour—amber *Variations from this may occur* even in health, e g , after exercise (perspiration loss) or with low fluid intake, or in warm weather—the urine then passed is concentrated and therefore of a deeper colour On the other hand large fluid intake or cold weather usually results in an increased volume of dilute urine being passed, this being pale coloured (normal pigment—urochrome)

Transparency—perfectly clear

Deposit on standing—slight or nil. A 'woolly' semi-transparent deposit of mucin is quite usual

Reaction—faintly acid or neutral to litmus

Specific gravity—1015–1025 Deep colour usually goes with a high S G and pale colour with a low S G

Method To carry out a routine test the nurse should —

a Note the *colour* and the *presence of any deposit*

If on naked eye examination of a specimen of urine which has been standing a deposit is seen it may be either phosphates or pus (if white), urates (if pink), or blood (if red)

The nature of a deposit may be determined by the results of heating or the addition of acid, as follows —

	Colour	*Reaction*	*Heat*	*Acetic Acid*
Urates	Pink	Acid	Dissolve	No change
Phosphates	White	Alkaline	No change	Dissolve
Pus	White	Frequently alkaline	No change	No change
Blood	Red brown	Varies	No change	No change

Microscopical examination of deposit for pus cells is the only satisfactory confirmatory test

Effects of drugs, etc , on the colour of urine Drugs such as senna and rhubarb may cause the urine to be reddish-orange in colour Methylene blue gives a blueish-green colour Cheap sweets tinted with dyes may produce a greenish-red 'shot' effect A false acetone result may be obtained if the patient has been taking salicylates

b Test the *reaction* of the urine This is done by dipping into it a small piece of blue litmus paper if the paper turns

pink the urine is acid if the paper does not change colour it is either neutral or alkaline, pink litmus paper will turn blue if the urine is alkaline

c Measure the *specific gravity* This is done by means of a urinometer

d Test for *'sugar'* 2½ c c of Benedict's reagent is placed in a test tube and four drops of urine are added to it by means of a pipette and the mixture is then boiled The presence of sugar leads to a change in colour, either green, yellow green, yellow-orange, or brick red, according to the amount present, e g, green indicates a trace of sugar

e If (*d*) is positive, test for *acetone* bodies To 1 in of urine in a test tube is added ferric chloride 10 per cent drop by drop, if acetone is present a purple colour will result

f Test for *albumin* Three inches of clear or filtered urine is placed in a test tube The lower portion of the test tube is held and the upper half boiled after the addition of a few drops of acetic acid If albumin is present a 'cloud' will appear in the heated portion, this should be reported as 'trace', 'moderate', or 'heavy' cloud

N.B If the urine is not acid it should be made so by the addition of a few drops of acetic acid before commencing tests

Further tests may be carried out by the nurse if necessary —

g Blood (the urine may be red or more commonly 'smoky') About ½ in of urine is placed in a test tube and a few drops of tincture of guaiacum added and the mixture well shaken, in another tube is placed 1 in. of ozonic ether A little of the first mixture is carefully added to this ozonic ether and if blood is present, a blue ring will develop at the meeting place of the two fluids

h Bile The urine will probably show a greenish tinge

Hay's sulphur test 1 in of urine is placed in a test tube and a pinch of flowers of sulphur is dropped on to the

surface, if bile-salts are present the sulphur will sink to the bottom, whereas in normal urine it floats

N B There are alternative tests for most of those which have been described, the most reliable ones having been chosen for the purpose of this chapter

Only microscopical examination can prove the presence of bacteria in urine, but their presence may be suspected when a filtered urine remains cloudy

In cases where results of ward tests are doubtful, a specimen of the urine must be sent to the laboratory

Pathological Examination for Tubercle Bacilli —A 24-hour specimen should be collected and either the whole amount or the deposit after standing sent to the laboratory Some of the centrifuged deposit is fixed on a slide and stained by the Ziehl-Neelsen method (the technique of this has been described earlier in this chapter)

The smegma bacillus in urine is liable to be confused with the tubercle bacillus, therefore the majority of laboratory technicians prefer to use the guinea pig test to obtain a reliable result Some of the urine is injected into a guinea-pig, the animal is killed (if it does not die) some weeks later, and if tuberculosis is found it is established that the urine contained tubercle bacilli

3 **Pleural Fluid** —The specimen is drawn off by means of an aspirating needle (the technique of aspiration is described in the chapter on COMPLICATIONS OF PULMONARY TUBERCULOSIS) It is sent to the laboratory in a sterile tube and examined by the Ziehl-Neelsen method

The fluid may be a clear straw-colour, greenish, blood-stained, or thick and purulent

In a case of pleurisy in which tuberculosis is suspected but has not been proved, the guinea pig test may be used

4 **Cerebrospinal Fluid** —This is obtained by lumbar puncture performed by the ward doctor The fluid is received into a sterile tube and sent to the laboratory

The nurse will prepare the trolley as follows —

Top shelf sterile bowls, swabs and towels, methylated ether and iodine, sterile water, a 2-c c. hypodermic syringe and needles, local anæsthetic, lumbar puncture needle, and rubber tubing with a graduated glass tube or special manometer

Lower shelf receiver for dirty swabs

Procedure —The nurse places the patient in the lateral position on the edge of the bed, with knees drawn up and head down so that the lumbar spine is in the correct position The doctor cleanses the skin and places the towels, he then introduces the local anæsthetic between two of the lumbar vertebræ below the level of the spinal cord the lumbar puncture needle is pushed through the anæsthetized area into the theca (subarachnoid space), cerebrospinal fluid will flow out through the needle into the test tube, which the nurse should hold, she replaces the cork as soon as the specimen has been collected. The doctor measures the pressure of the fluid by means of the graduated glass tube, he then removes the needle, cleanses the skin, and seals the puncture with collodion It is advisable for the patient to lie flat in bed for some hours afterwards to prevent the occurrence of headache, the foot of the bed may be raised on blocks

In normal cerebrospinal fluid the pressure is found to be about 100 mm. whereas in tuberculous meningitis it is raised to 200 mm or more Also in this condition the chloride content is low and the number of lymphocytes is increased, on standing a 'spider-web' clot usually forms, the fluid when obtained is very often clear In some cases tubercle bacilli are found in the fluid, but the above findings are conclusive evidence of tuberculous meningitis

5. Fæces —Tubercle bacilli may be found in the stools in cases of tuberculous intestinal ulceration or from swallowed sputum in pulmonary tuberculosis A special jar with a spoon attached to the cork is commonly used The nurse

should take care that the stool has been passed into a clean bed pan and that the spoon touches nothing but the fæces when picking up a specimen

The specimen is sent to the labarotory and examined in the usual way

6. Tuberculin Skin Tests—These are of value only in a 'negative' way A 'positive' reaction indicates that the person has had some tuberculous infection most people have been exposed to such an infection at some time or other, therefore a positive result is usual If a person is 'negative' it means that he has never been even slightly infected and therefore has no immunity It is not considered advisable for a negative person to work among tuberculous people

a Mantoux Test—One tenth of a c c of 1–10,000 tuberculin is injected intradermally—a 'control' being used elsewhere If a red, œdematous area appears at the site of the tuberculin injection within 48 hours the result is positive If it is negative, the test is repeated, using 1–1000

b Vollmer Patch Test (used mainly in children)—A patch of material impregnated with tuberculin is stuck on to the skin, a positive reaction will show after 48 hours as a raised reddened area. This test is not as reliable as the intradermal injection

c Von Pirquet Test—The arm is scarified (scratched) and a small quantity of tuberculin rubbed in—a 'control' of some harmless fluid is used on a separate scarified area Redness on the first site indicates a positive reaction

7. Vital Capacity—This test is used, particularly pre- and post-operatively, to determine the capacity of a patient's lungs He takes a deep breath and blows out as much as he can into a large rubber tube connected to a spirometer (*Fig* 20) A gauge attached to the machine shows the amount of air which has been expired The vital capacity varies enormously with different patients according to the size of the thorax, general physique, the amount of lung disease present, etc It may be as low as a few hundred

c c or as high as 3500 c c or more It may be of great assistance to the doctor, indicating the progress of the patient if carried out at regular intervals

8 **Blood Sedimentation Rate.**—This is more correctly termed erythrocyte sedimentation rate, and it indicates the rate at which the blood-cells fall in a vertical column of

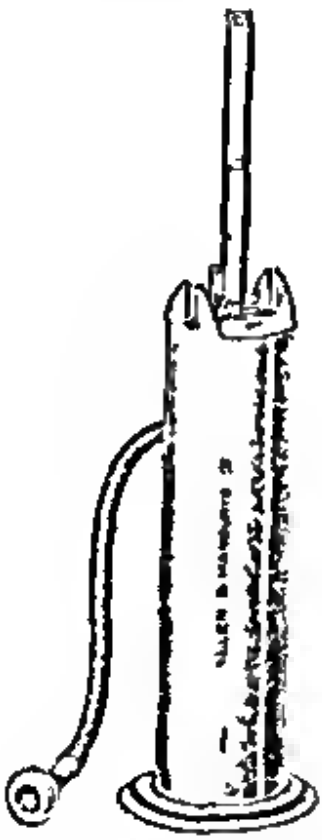

Fig 20 —Spirometer used for measuring vital capacity

whole blood There are several methods, the Westergren method will be described here The test may be carried out by the ward doctor or, in some sanatoria, by the sister or senior nurse

A 2-c c hypodermic syringe with a sharp, fine needle is used, 0 4 c.c. of sodium citrate 3 8 per cent is drawn up into the syringe (If the sodium citrate is contained in a rubber-capped bottle, a separate needle should be kept for insertion into this) The patient is instructed to grip the

upper arm firmly with the fingers of the other hand or an assistant can do this, the veins will then become prominent, the skin is cleansed with methylated ether or spirit and the needle (attached to the syringe) is inserted into one of the

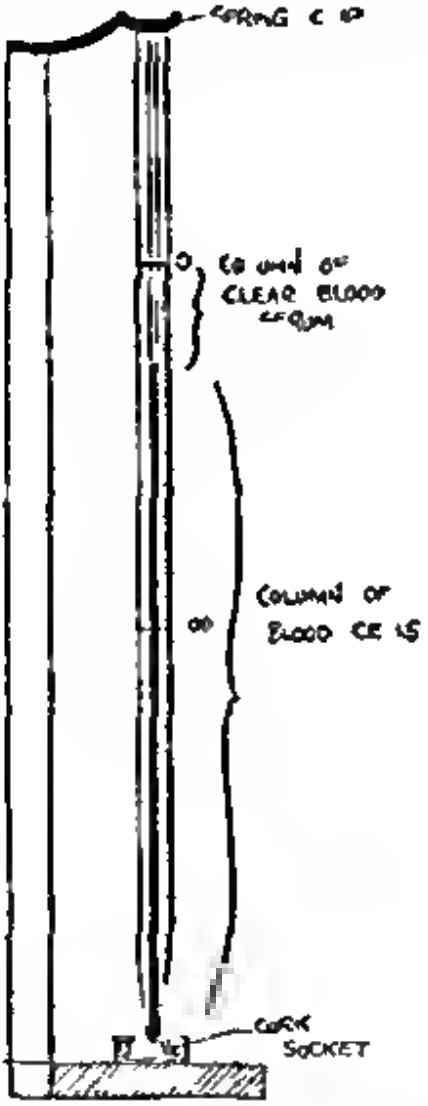

Fig 21.—Erythrocyte sedimentation rate tube

veins, commonly the median basilic, and 1 6 c c of blood is drawn up into the syringe A spirit swab is placed on the puncture and the patient flexes his arm for a few moments to stop the bleeding The needle is removed from the syringe and the mixture of blood and sodium citrate squirted into a clean glass tube and shaken gently From this blood is drawn up to the '0' mark on a graduated 200-mm

glass tube which is placed vertically in a special stand (*Fig* 21) the tube is kept in position by a rubber cork at the bottom and a metal clip at the top The time is noted, and exactly one hour later the column of plasma left at the top of the tube is measured

For example, supposing the cells have fallen to the 20 mm mark, then the column of plasma left measures 20 mm and 20 is the B S R for that patient The normal rate for men is under 6 mm in one hour, and for women under 10 mm

Some doctors like a further reading to be taken after two hours

This test has no particular value in diagnosis, as the rate may be increased in other diseases and in the presence of mild infections such as a 'cold' or any septic focus, but it is valuable as a check on the progress of the disease if carried out at regular intervals and all other findings taken into consideration with it

In acute or advanced cases of tuberculosis the cells may fall rapidly and the reading be as much as 100 mm or more in an hour

N B The nurse must remember that whenever she is TAKING BLOOD FROM a vein the pressure on the arm must be released BEFORE withdrawing the needle, otherwise a haematoma will result

CHAPTER XIV

TUBERCULOSIS OF BONES AND JOINTS

TUBERCULOUS infection in bones and joints is nearly always secondary to tuberculosis in some other part of the body In children the primary focus may be in the mesenteric or mediastinal glands, an infection of the lungs is rare in children, in adults it is generally associated with pulmonary tuberculosis

The most noticeable general symptoms are lack of energy, loss of appetite and weight, and an elevated evening temperature, the chief local symptoms are pain at the site of infection, or it may be 'referred', swelling, rigidity or impaired movement of the joint, muscle spasm, muscular atrophy, followed by abscess formation and deformity

In the diagnosis clinical signs and symptoms are of the utmost importance, as they are present many weeks before a radiograph will reveal the changes taking place These changes are erosion of joint surfaces, destruction of the normal structure, and decalcification.

Local treatment consists of complete immobilization of the diseased joint by, preferably, a plaster-of-Paris splint, this relieves pain, prevents deformity, and also corrects any deformity that may have already become established Some surgeons prefer to have well padded metal splints applied, in this case immobilization is less complete, therefore greater care must be exercised in nursing the patient The advantage over a patient completely encased in plaster-of Paris is that heliotherapy can be carried out with more benefit to the patient

For patients on spinal frames or in plaster casts special beds are used, with divided mattresses or a 'trap-door'

and platform on which the bed pan can be placed, thus eliminating all movement These need much attention to pressure points, so a 'turning' case (*Figs* 22, 23)—a second plaster cast, which is applied to the front of the patient and strapped into position before turning the patient over—is used

The posterior cast can then be removed, and pressure points attended to, these should be as well protected as possible by rings of cotton-wool or felt, frequently renewed, and the routine treatment for prevention of sores carried out

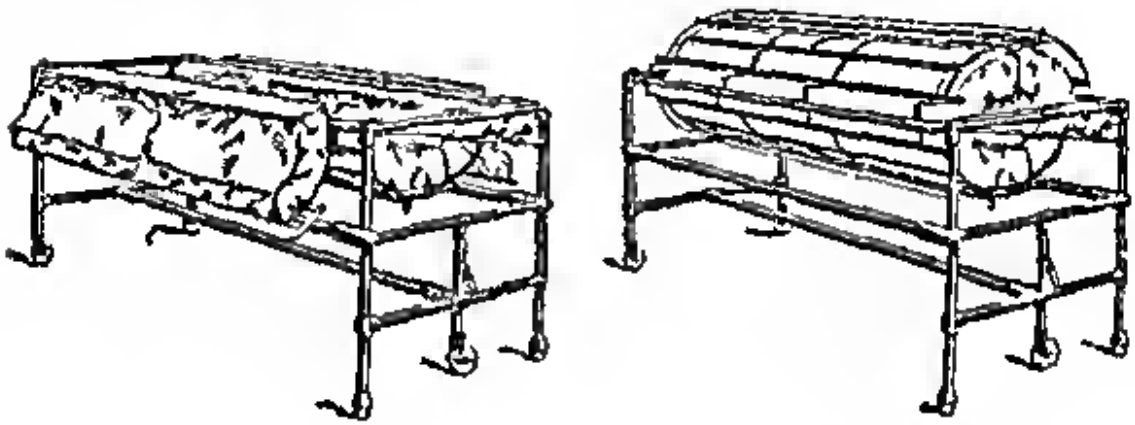

Fig 22.—Reversible bed frame for spinal cases

The backs of all plaster patients should be washed once or twice each day and rubbed well with spirit and powder Patients on frames or in casts often experience severe abdominal discomfort, this may be relieved by placing a pillow under the shoulders If this does not give relief the physician will no doubt order the administration of a suitable drug

Pott's Disease—that is, tuberculosis of the spinal column (sometimes called spinal caries)—is characterized by pain, rigidity of the spine, kyphosis, and occasionally abscess formation. These signs are preceded by the usual general symptoms already described

Pressure on the spinal cord resulting in paralysis may occur as the result of the rupture of an abscess into the

spinal canal The paralysis usually accompanies disease in the dorsal and lumbar regions and is spastic in character.

Treatment is complete immobilization in plaster-of Paris or on a special frame Surgical treatment may be employed, the chief operations being those of Hibbs and Albee, which consist of splitting the spinous processes of the vertebræ and then inserting as a narrow wedge a fresh strip of bone taken from the tibia This supplies the back with a natural splint, the support of which is increased by growth Until the graft is well established the patient remains in a plaster

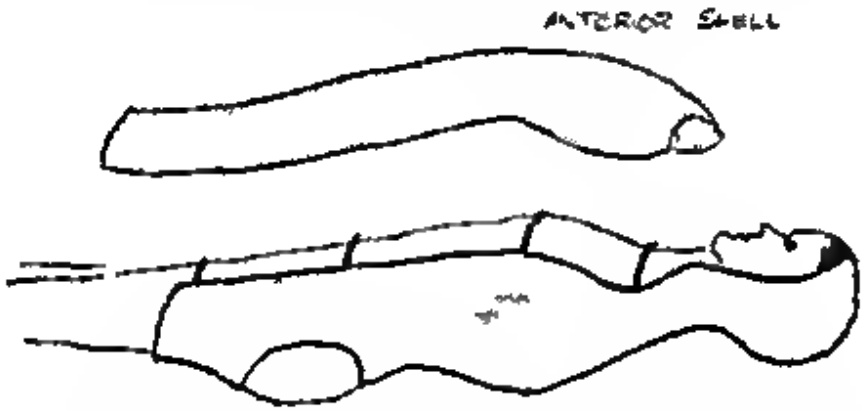

Fig 23.—Plaster cast for immobilization of spine Anterior shell used for turning the patient when back requires treatment.

cast, followed by a period of wearing a spinal jacket while ambulant Laminectomy is performed in some cases, in this operation the pillars of the spinal arches are divided, thus freeing the spinal cord from pressure Two plaster casts are made ready, the patient is lifted into one and the other is fixed over him

Tuberculosis of Joints—

Tuberculosis of the *hip-joint* causes pain, limping, and deformity in advanced cases, followed by abscess formation The disease usually arises in the synovial membrane, and spreads to the head of the femur, involving the acetabulum and destroying the joint formation

Shortening of the leg may be present if the bone is destroyed or in children by interference with growth

Treatment consists of the application of an 'extension splint, which separates the infected joint surfaces, and immobilization in plaster-of-Paris In adults it may be necessary to perform an arthrodesis by surgical operation, using a bone-graft to cause fixation Treatment may extend over a period of two to three years

Special beds with Balkan frames are used for extension cases

Tuberculosis of the *knee joint* is most common in children, and after the hip it is stated to be the joint most affected Pain and swelling followed by a 'limp', as well as muscular atrophy and limited movement, are the chief symptoms Here, too, the extension splint is used in treatment, followed by immobilization in plaster-of-Paris After about three months of this treatment a walking calliper may be used for one to two years, but if ankylosis has occured earlier the calliper can be discarded This applies to children, but in the case of an adult operative treatment may be necessary to remove the synovial membrane and bring about ankylosis by excising the diseased joint surfaces The operation is not undertaken until all activity of the disease has subsided, all cases are not suitable for this operation, the alternative, therefore, being amputation

Infection of the *ankle and tarsal articulations* is characterized by swelling and localized pain on weight-bearing, causing a limping gait. Treatment, as for all other joints, is immobilization in plaster of-Paris—from knee to toes, after a year or so of this a walking calliper—Böhler's iron—may be applied for a few months This calliper is fixed above the ankle by plaster-of Paris In children the prognosis is good, in adults, though some make good recovery, there are some in whom the disease progresses, involving the tendons around the joint, and after prolonged infection the patient may become very ill owing to toxic absorption—if this occurs surgical treatment consisting of amputation of the leg in the middle third is performed

When the *sacro-iliac joint* is infected there is pain in the back on walking and atrophy of the gluteal muscles Pain may be found over the infected area on compression of the crest of the ilium Treatment consists of immobilization of the patient in a plaster of-Paris splint or a double Thomas splint The thigh of the wound side, as well as the lumbar region of the spine, the hip, knee, and foot of the affected side, are immobilized When the patient is allowed up a plaster 'jacket' is worn for several months, followed by the wearing of a special spinal or sacro-iliac belt, for which the patient is measured and fitted

Treatment of tuberculosis of the *shoulder joint* is immobilization of the joint in an abducted position with the elbow brought slightly forward To fix the joint a plaster spica or a shoulder splint of metal may be employed

In tuberculosis of the *elbow joint* the ulna is the bone most frequently involved, pain, swelling, atrophy of the muscles, and *limited movement* are the *chief symptoms* Immobilization is the first stage of the treatment, and is obtained by the application of a plaster of Paris splint extending from shoulder to wrist As the acute stage subsides, a special splint—'collar and cuff'—may be used instead of plaster

Tuberculosis of the *wrist* is often found in adults suffering from pulmonary tuberculosis, the chief symptoms are pain, swelling, muscular atrophy, and abscess formation The joint is immobilized in plaster-of Paris if there is no discharging sinus, the splint usually extends from elbow to finger tips A metal splint is used if there is a discharging sinus

Tuberculous dactylitis is characterized by painless swellings of the toe or finger joints This condition is often chronic and abscesses which break down and discharge may complicate the condition Immobilization is carried out by the application of splints to the affected toe or finger It may be necessary to remove dead pieces of bone first Prognosis is good, but a shortening of the digit involved

will be present, especially in children where the growth is interfered with

Tuberculous Osteomyelitis—This term is used when the bacillus attacks the bone first The bones chiefly affected are the ends of long bones, such as femur, ulna, etc, and the short bones of the hands and feet The tubercles which are formed unite rapidly and the bone substances are gradually absorbed Caseation, resulting in the formation of a cold abscess, may occur at any time The disease may make its way through the periosteum, giving rise to periostitis, or it may extend along the bone to a joint In these cases the result may be that a portion of healthy bone becomes completely surrounded by diseased tissue, the latter cuts the blood supply to the healthy bone, so that it gradually dies This portion of dead bone, called a 'sequestrum', may remain in the tissue for years

Tuberculous Periostitis—This form of the disease usually attacks the ribs, skull, sternum, and vertebral column Tubercles unite and caseation takes place, followed by the formation of pus, which lies between the periosteum and the bone and tends to separate them The result of this is that the bone degenerates and a process of 'caries' ensues

In the treatment of all cases of bone disease rest, fresh air, good nourishing food, with a plentiful supply of vitamins, are the chief essentials Sun-bathing is also beneficial, but must be carried out in moderation and under medical supervision In winter carbon-arc and mercury-vapour lamps are used as a substitute for the natural sun Some doctors and surgeons prefer to have their cases nursed in the open air, for this balconies are provided with adequate protection from the elements, and it is possible to keep patients out-of-doors all the year round if the protection is suitable They are kept warm by means of extra bedclothes and hot-water bottles

CHAPTER XV

TUBERCULOSIS OF THE CERVICAL LYMPH-GLANDS, ABDOMEN, AND GENITO-URINARY SYSTEM

TUBERCULOSIS OF THE CERVICAL LYMPH-GLANDS

The infection reaches these glands via the tonsil, caseation occurs, with the production of pus and possibly sinuses, there is usually some constitutional upset

Treatment—The swellings in the neck may be aspirated, and the part kept at rest by the application of plaster-of-Paris, a band being placed around the head to produce immobility of the neck Ultra-violet rays are beneficial, and in some cases X ray treatment is used Sunshine, rest, fresh air, and good food are invaluable Tonsillectomy is often performed later

TUBERCULOSIS OF THE ABDOMEN

A. **Primary Infection**—This may be human or bovine, a primary focus in the lung (Ghon's focus) is always accompanied by swelling of the hilar glands, and these two factors constitute the 'primary complex' if the bacilli have been swallowed the primary focus occurs in the intestines, with accompanying involvement of the mesenteric glands (tabes mesenterica)

The consequences of a primary infection may be —

1 Healing, with no further tuberculous disease, on X-ray examination calcified foci will be seen

2 Spread to bones and joints, genito-urinary tract, or the peritoneum, or a generalized miliary tuberculosis

3 Spread to glands, cervical or abdominal

If intestinal ulceration is sufficient to produce symptoms, the infection is probably NOT primary

Tabes Mesenterica—This is found most commonly in children The abdominal glands caseate, break down, and form a palpable mass

Symptoms The child is fretful, does not gain weight, and is usually febrile There may be diarrhœa or constipation, if the latter, the symptoms of obstruction will be noted

Diagnosis is made from the above symptoms, together with an X-ray examination, which may show calcified glands, and a Mantoux test (if this is negative some other cause for the symptoms will be looked for)

Treatment General rest, fresh air, good food, with the addition of vitamins, are essential Sunlight is beneficial, as is ultra violet ray therapy and treatment by X rays If constipation is present liquid paraffin should be given, it is better to give a small dose three times daily than one large dose

B. **Secondary Infection**—In conditions arising from secondary infection, ulceration occurs with NO involvement of the regional glands The ileocæcal region is commonly affected There are three main types of disease (1) ulcerative, (2) fibroue, (3) hypertrophic (overgrowth of tissue-forming tumours)

This last type is found most commonly in males of about 40 years of age, having no pulmonary lesions

Symptoms Abdominal pain, tenderness, rigidity, diarrhœa, blood and mucus in stools, and marked wasting In types (2) and (3) there may be symptoms of obstruction

Complications (1) Peritonitis (2) Hæmetemesis and melæna stools, (3) obstruction, partial or complete

Diagnosis is made by X-ray examination following a barium meal and by sigmoidoscopy (the passing of a telescopic instrument—a sigmoidoscope—into the rectum and up to the sigmoid flexure of the colon), which will show any abnormality of the lower bowel

Treatment General sanatorium regime is necessary, i e, rest and fresh air Sunlight or ultra-violet ray therapy is

beneficial if the chest is normal Pneumoperitoneum is sometimes performed, but there is not as yet sufficient evidence to prove its value

Diet should be nourishing, if diarrhœa is troublesome a bland diet should be given, avoiding roughage and highly seasoned or irritating foods

Drugs *to check the diarrhœa are chalk or bismuth mixtures*, with the addition of tinc opii if necessary Calcium gluconate may be given intravenously In the terminal stages, where pain is severe, morphine is given

Surgical treatment In the hypertrophic type, the tumour may be removed successfully in most cases Apart from this, surgery is *contra-indicated* and only resorted to in cases of *complete obstruction, i e, where vomiting is persistent* and the bowels do not act even after turpentine enemata, the prognosis is poor

Tuberculous Peritonitis—This may result from (1) Outward spread from diseased glands, (2) Ulcers in the intestinal wall, (3) Blood stream infection, either primary (miliary) or secondary infection from some other organ, *e g, the Fallopian tubes It is commonest in* young people

Types (1) Serous (ascitic), (2) Adhesive

In the first type there is free fluid in the abdominal cavity and the peritoneum is studded with tubercles, in the second type bands of fibrous tissue are present, causing pain (this is often mistaken for a malignant tumour or appendix abscess) There is an intermediate type, where caseous matter is present.

The prognosis is good in the first type, especially in children, and poor in the second

Treatment General sanatorium conditions are essential, with the addition of ultra-violet light *Fluid may* be aspirated, sometimes the fluid is replaced with air to establish a pneumoperitoneum

Diet should be nourishing and easily digested

GENITO-URINARY TUBERCULOSIS

1. **The Kidneys**—The infection is probably from the blood-stream, and the condition occurs most frequently in patients of 20–40 years of age The ureters and bladder may become involved

Symptoms Increase in the amount of urine passed, frequency of micturition, pain at times, especially if the bladder is involved, and often hæmaturia (blood in the urine) There may be some constitutional upset, particularly a rise in temperature

Diagnosis A 24-hour specimen of urine is sent to the laboratory and examined for tubercle bacilli (details of this will be found in CHAPTER XIII) If the result is 'positive' investigations are then carried out to determine which kidney is affected X-ray photographs are taken following an intravenous injection of uroselectan (intravenous pyelography) and/or sodium iodide introduced through ureteric catheters (retrograde pyelography) A ureteric catheter may be passed up each ureter and a specimen of urine from each kidney examined separately

If the patient is febrile and appears ill, it may be necessary to give him a period of bed rest before the above investigations are carried out

Treatment Rest in bed, with good food and fresh air until the patient is afebrile If only one kidney is found to be affected it is removed (nephrectomy) following the operation a further period of general sanatorium treatment is necessary

If both kidneys are affected surgery is out of the question and the prognosis is poor, though the patient may, with care, live for years without an undue amount of discomfort

Medicines, such as potassium citrate with sodium bicarbonate or hyoscyamus, are given, and measures taken to build up the patient's general condition If he is afebrile and his general health fairly good, he may subsequently be

allowed up for certain periods of the day Frequency is a distressing symptom and the discomfort and embarrassment arising from it should be thoroughly understood by the nurse, the patient should have a urinal by his bed night and day and this will require frequent emptying

The urine should be watched for signs of blood, it may be merely 'smoky' in colour or obvious blood may be seen, or in some cases clots may be passed Treatment for this is similar to that for hæmorrhage from other parts of the body, i e, rest and injections of calcium or vitamin K

2 **The Testicles**—Any of the genital organs may be affected, in males the infection most commonly shows itself in the epididymis, with abscess formation

Treatment General sanatorium treatment is advisable Orchidectomy (removal of the testicle) may be performed in selected cases, with removal also of the vas deferens if affected

3 **The Fallopian Tubes**—This occurs in young girls and a chronic salpingitis or pyosalpinx may result

Symptoms Pain and fever

Treatment Unless there is much adhesion of bowel coils around the tube, operation for removal of the tube is undertaken General sanatorium treatment is given, as for abdominal tuberculosis If both tubes are affected the woman will most probably be sterile

CHAPTER XVI

PREVENTION AND GENERAL ADMINISTRATIVE MEASURES

THE prevention of the spread of tuberculous infection depends very largely on the education of the general public in matters of hygiene We have seen that tuberculosis is spread in two ways (1) By dissemination of bacilli from an infective person to those in contact with him, and (2) By infected milk

1 The Ministry of Health has used energetic measures to combat the first of the above methods of spread, including —

a The institution of fines for spitting in public vehicles and buildings (One authority has stated that if no one ever coughed or spat at large the human form of tuberculosis would disappear in two generations)

b Slum clearance, the evils of overcrowding are being more widely recognized

c The provision of adequate numbers of beds for tuberculous patients in hospitals and sanatoria (In Britain at the present time, owing partly to the exigencies of the recent war, this scheme is being hampered by shortage of nurses and domestics, the Ministry recognizes this and seeks to improve conditions for tuberculosis workers in order to attract more nurses and domestics to this important work)

d Compulsory notification of tuberculous persons private doctors are legally obliged to notify every new case of tuberculosis in order that the patient may be treated, until the disease is under control the patient is a potential source of infection to all who may be in contact with him

e Education of the public on the subject of adequate diet, in co-operation with the Ministry of Food

f Improvement in conditions in factories mines workshops and schools

g Setting up of Tuberculosis Dispensaries the function of these will be described in the next chapter

h Introduction of a scheme of financial allowances so that patients may complete their treatment without fear of hardship for their dependents

1 Mass miniature radiography this has been used so far on large sections of the public, notably in the Services and in some factories It is hoped that the scheme will be extended to cover the whole population It is a convenient and rapid method of taking X ray pictures and by means of it the early symptomless case can be diagnosed and treated before the person becomes a source of danger to others The picture is recorded on a very small film, this is thrown on to a fluorescent screen and any abnormality noted a full size X ray photograph is taken of every suspicious chest

The National Association for the Prevention of Tuberculosis (N A P T) in America and Britain is doing much useful preventive work by the use of posters magazines, booklets, etc, which seek to give to the general public useful information about the disease and instruction on the subject of the prevention of infection N.A P T also organizes refresher courses for doctors and other tuberculosis workers

2 Milk from tuberculous cows will contain tubercle bacilli Tuberculin tests and pasteurization have done much to reduce the incidence of milk borne diseases Tuberculin Tested (T T) milk comes from special herds of cows guaranteed to be free from tuberculosis (each cow is tuberculin tested frequently), this milk is not warranted free from other bacteria and pasteurization is advisable—this is done on a large scale and most consumers now purchase milk

which has already been pasteurized The process consists of heating the milk to a temperature for 145–150° F and allowing it to remain at that temperature for half an hour, then cooling it to 55° before bottling, the bottles being sterilized by a special mechanical process

Certain stringent measures have been taken to ensure hygienic conditions for all cows, and inspection of the sheds and byres and milking apparatus is carried out by qualified Health Inspectors Examples of the regulations now in force are —

a Cow-sheds must be light and airy, the walls and floors must be washed daily, and the walls whitewashed periodically,

b Bedding (if present) must not be disturbed for an hour prior to milking,

c Pails must be of a special pattern, with narrow mouths and no crevices,

d No tuberculous person is permitted to milk cows or handle milk in dairies

A pure milk-supply does much to prevent the spread of the bovine type of tuberculosis In this connexion it should be emphasized that infection may still be transmitted to a child through milk, although the milk was 'clean' on delivery, a tuberculous mother or nurse may cough into the milk while preparing the child's feed and thus present him with a massive dose of bacilli Obviously, a knowledge of the dangers of infection is essential and practical health measures must be combined with education if any preventive scheme is to be successful

It is hoped that, with continued world peace, adequate food and housing for all, and the avoidance of fatigue caused by long working hours, the incidence of tuberculosis will fall considerably

Until some vaccine is discovered which will protect the body against this infection, the most we can do is to increase the resistance of the individual so that his body is able to

withstand the invasion of the bacillus when it attacks him An early primary infection often ensures lasting immunity, in opposition to this, the danger of serious disease occurring as a result of such an infection at certain ages, i e , in very young children and in young adults, is so great that we cannot knowingly allow them to risk contact with open tuberculosis

4 Examination of contacts, including X-ray photographs

5 Minor treatments such as artificial pneumothorax refills

6 Periodic examination of ambulant patients receiving domiciliary treatment

7 Examination and supervision of patients discharged from sanatoria

8 After-care supervision, i e , advice to patients whose disease is 'arrested' or 'quiescent' with regard to work, housing, and mode of life, and instruction as to when to report for subsequent 'check-ups'

9 Welfare work through the Welfare Committee

CHAPTER XVIII
REHABILITATION

THE tuberculous person, on discharge from a sanatorium, is at a great disadvantage in the world of commerce, if he competes with healthy people he runs the risk of breaking down and undoing the good which has been done The economic factor has to be considered here, if a patient has private means he is able to take a suitable light part-time job at a nominal salary and gradually increase his hours of work as he regains his physical strength the person without such means cannot live on the remuneration from a part-time job even if he is able to get one, and therefore he attempts to do a full day's work and endangers his health

Sometimes a change of occupation will prevent the break-down, e g, if a patient who was formerly doing manual work can be transferred to a sedentary job he may be able to work a full day in that capacity Unfortunately, it is not always easy to change one's occupation

The most successful experiment in overcoming this difficulty has been the Tuberculosis Colony more of these are needed and much more would probably have been done in this direction had it not been for the war Now more than ever are they needed, as numbers of repatriated prisoners of war who developed tuberculosis in prison camps will require rehabilitation after treatment

A typical colony consists of hospital blocks, a sanatorium and workshops, and also hostels to which patients graduate from the sanatorium and live in conditions which approximate more nearly to normal life

In the Village Settlement type of colony, the inhabitants enjoy village life and have their own shops and places of entertainment, and in some cases their own churches and inn

Cottages are let cheaply to tuberculous men who are well enough to put in a certain number of hours in the workshops, gardens, etc., and who have families willing to share the life with them The patient and his wife and children are all under medical supervision and are examined periodically parents are given instruction on the prevention of infection and it is extremely rare for a healthy child to become infected from the father in these conditions A school is provided for the children, and transport is arranged for those who gain scholarships to senior schools in the nearest town The hospital and sanatorium blocks in the village are available for any cottager or hostel resident who may be so unfortunate as to break down, thus relieving him of some anxiety, he knows that he will not lose his job through illness, but will be able to resume it on recovery, even if at first he has to 'go slow' and work less hours

The best-known Village Settlement is situated at Papworth in Cambridgeshire, England, and was founded by the late Sir Pendrill Varrier-Jones, who was one of the first medical men to realise the plight of the tuberculous man in his endeavour to earn his living and reinstate himself in society after treatment In this connexion, nurse-readers will be interested to know that Papworth has a special scheme for the rehabilitation of the tuberculous nurse Both trained and untrained nurses, whether their treatment is completed or if they are still receiving it (e g , artificial pneumothorax refills), are admitted to a very up-to-date and comfortable Nurse's Home They are graded from three to eight hours' work daily according to their condition and they nurse in all the hospital wards and in the hostels

Frequent and thorough routine examinations are given and the grades adjusted accordingly Should a nurse have a 'breakdown' she may have a period of rest in the Home or, if necessary, she may be transferred to the hospital block where there are a few beds especially endowed for nurses Many nurses proceed up the scale to 8 hours' work and remain

there, if the disease appears 'arrested' they may, if they wish, move on to general work in other hospitals, on the other hand, some nurses remain on 6 hours' work indefinitely as more would be harmful

If and when a nurse is fit enough to work a full eight-hour day, she is given the opportunity to train for the certificate of the Tuberculosis Association It is interesting to note that so far 75 per cent of the nurses who have gained this certificate at Papworth have been tuberculous nurses

Most colonies try to suit the work to the patient and have facilities for training him in a new occupation if it is inadvisable for him to return to his former one In some Settlements, e g, Papworth, physical tests, carried out under the supervision of a specially-trained doctor, are used in assessing a patient's 'physical efficiency' and have proved invaluable in preventing overstrain, just as psychological tests prevent 'square pegs in round holes'

Outside the settlements, little is available in the way of 'sheltered employment' It is hoped that in the future more factory administrators will co-operate by instituting special facilities for part time workers, as has been done in the Altro Workshops, New York, and in parts of Russia

Until some prophylactic treatment is discovered and made generally available, three factors are essential if we are to wage a successful war against the tubercle bacillus —

1. Hygienic conditions for the whole community
2 Adequate treatment for the tuberculous
3 Energetic measures for rehabilitation, which will only prove successful if the general public is 'educated' and the lay attitude to tuberculosis is converted from one of apathy to one of constructive sympathy and active co-operation

The tuberculous patient is, as a rule, cheerful and courageous in the face of great odds, and deserves the best possible nursing and every consideration In rehabilitation, he needs continued encouragement to develop his self-confidence; and a background of financial and social security.

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